United States
Department of
Agriculture

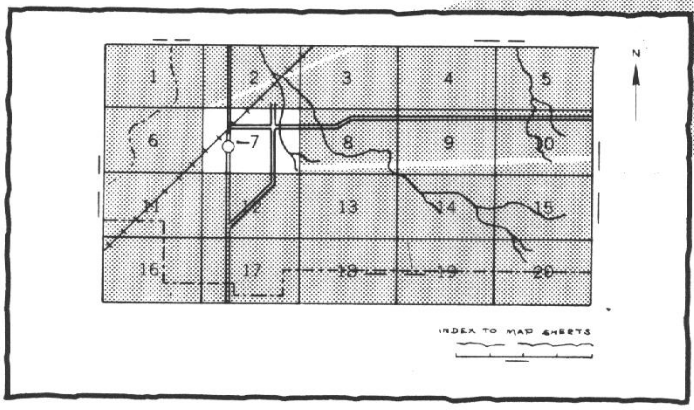
Soil
Conservation
Service

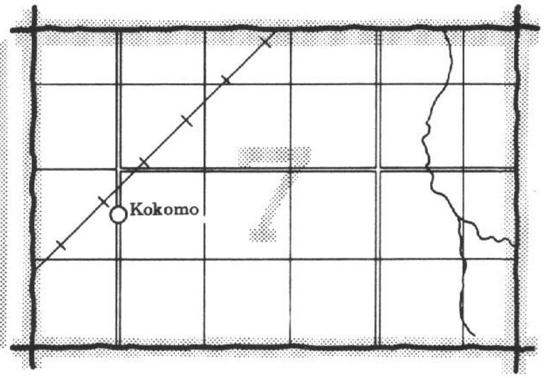
In Cooperation with
University of Nebraska
Conservation and
Survey Division

Soil Survey of Box Butte County Nebraska

HOW TO USE

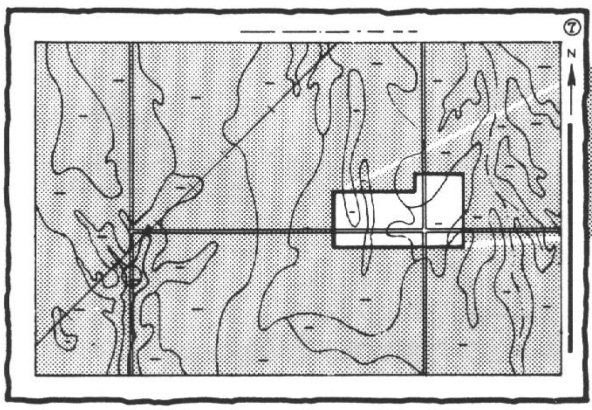
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

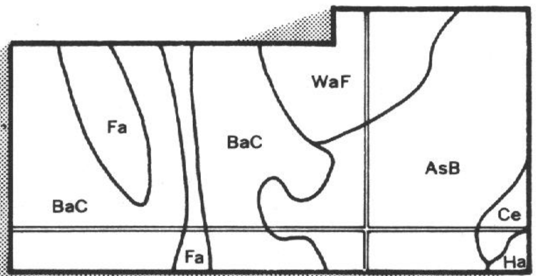




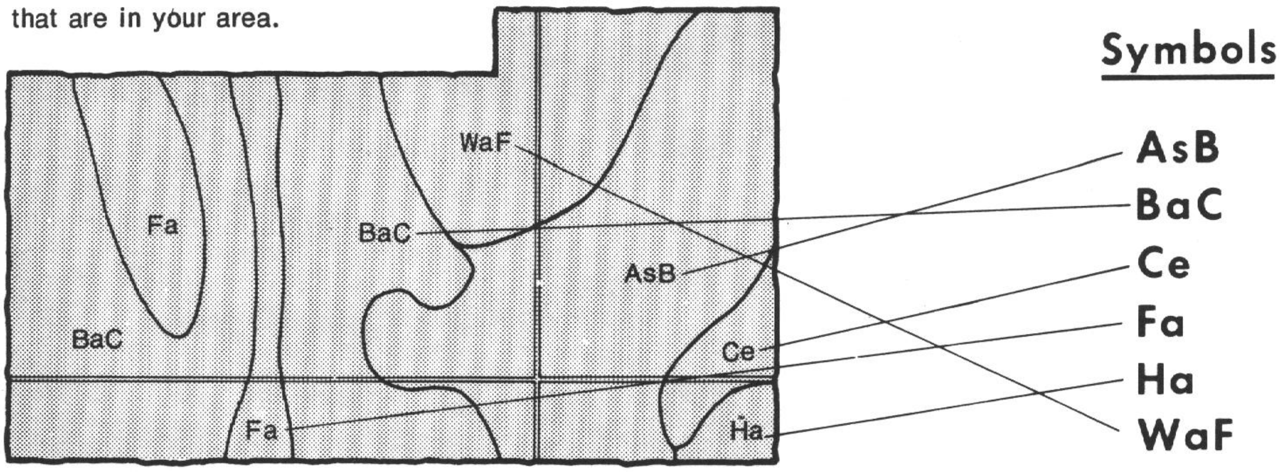
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



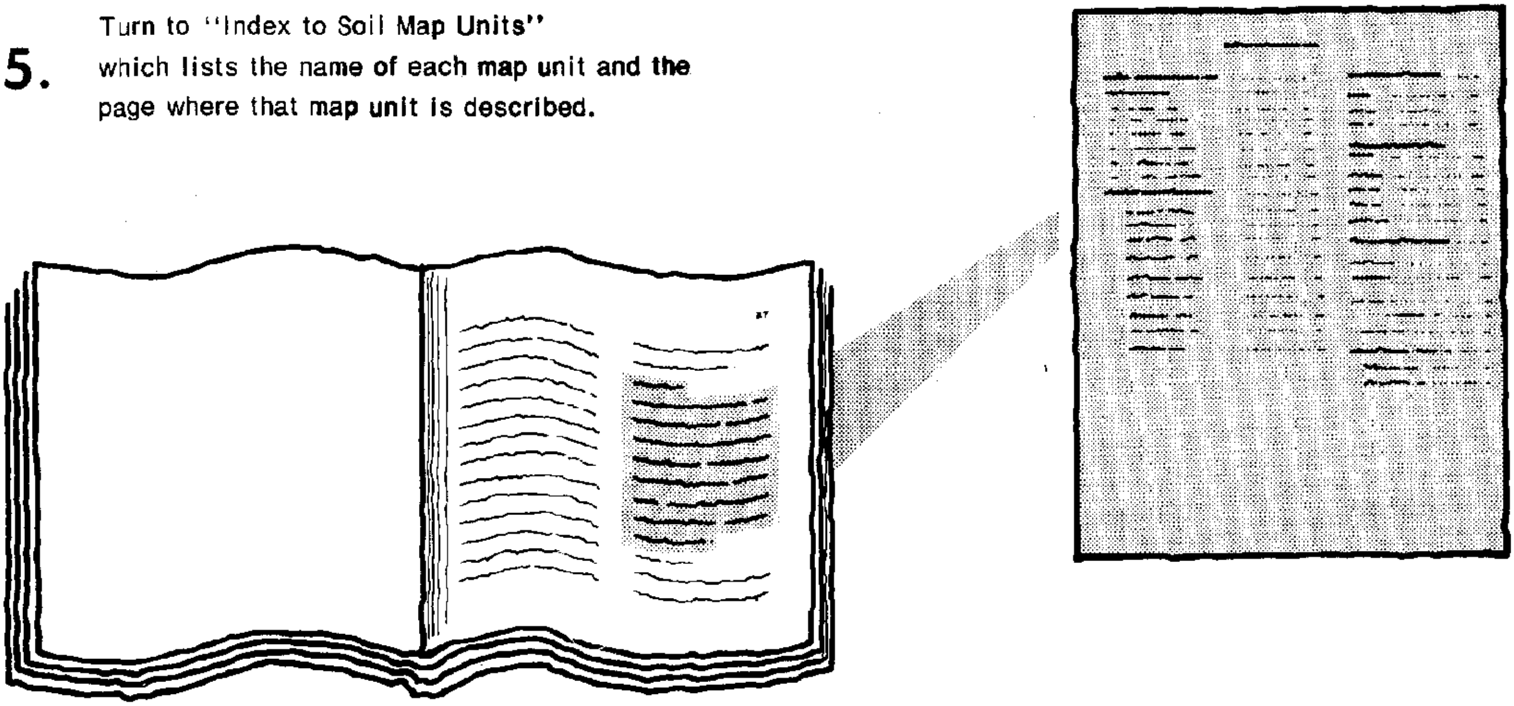


4. List the map unit symbols that are in your area.

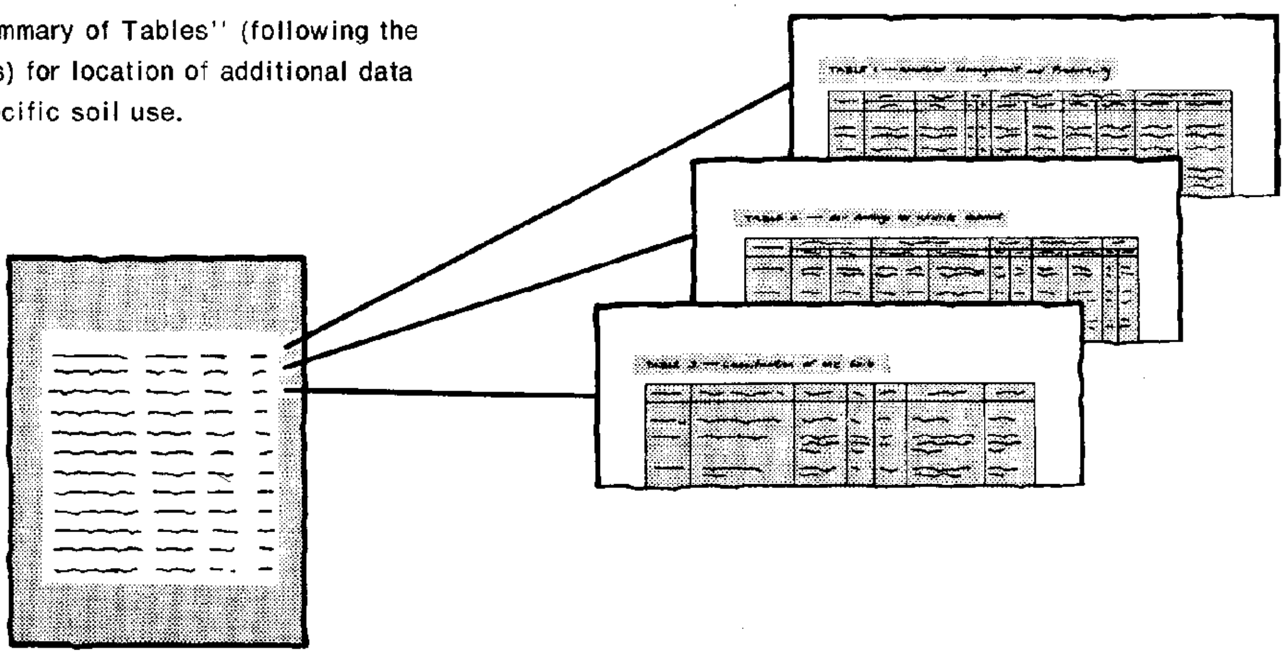


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. The University of Nebraska, Institute of Agriculture and Natural Resources, Conservation and Survey Division, has leadership for the state part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Upper Niobrara and White Natural Resource District. The Upper Niobrara and White Natural Resource District provided funds for some of the aerial photography and fieldwork.

Major fieldwork for this soil survey was completed in 1979. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Soils in the Alliance-Rosebud-Keith association are used mainly for cultivated crops, both dryland and irrigated.

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Issued October 1983

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Foreword

This soil survey contains information that can be used in land-planning programs in Box Butte County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Sherman L. Lewis
State Conservationist
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Soil Survey of
Box Butte County, Nebraska

By Charles F. Mahnke, Dan R. Shurtliff, Rita Dallavalle, Norman P. Helzer,
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United States Department of Agriculture, Soil Conservation Service,
in cooperation with University of Nebraska,
Conservation and Survey Division

BOX BUTTE COUNTY is in the northwestern part of Nebraska (fig. 1). It is bordered on the south by Scottsbluff and Morrill Counties, on the west by Sioux County, on the north by Dawes County, and on the east by Sheridan County. It covers an area of 1,065 square miles, or 681,728 acres. Alliance, the county seat, is the largest town.

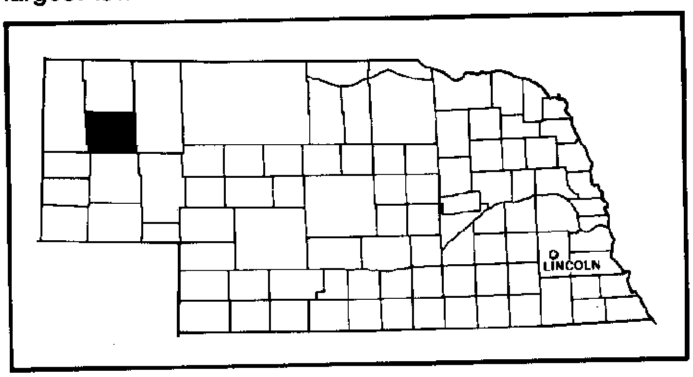

Figure 1.—Location of Box Butte County in Nebraska.

Commerce and industry are important in the county, particularly in Alliance, which has become an important railroad center. The railroad is a major employer in the county. Agriculture is the main enterprise. Winter wheat, corn, sugar beets, and field beans are grown extensively for cash income. Alfalfa and potatoes are also grown. Livestock ranching also is an important enterprise in the county. Most of the ranches produce feeder calves.

Box Butte County has good facilities for transportation. Railroads provide freight service to Alliance and Hemingford. Air and bus service are also available at Alliance. The county is traversed by several all-weather surface highways. U.S. Highway 385 provides a north-south route mainly in the eastern part of the county. Nebraska Highway 2 provides a route across the county from the southeast to northwest. Nebraska Highway 87 is an east-west route in the northern part. Rural roads are generally on section lines. A few of these are hard surfaced, but most are crushed rock or dirt.

Public schools ranging from elementary grades through high school are in Alliance and Hemingford. Several elementary schools serve the rural areas of the county.

About 36 percent of the acreage in the county consists of soils in capability class II, as defined in the section "Use and Management of the Soils." Class III soils make up about 16 percent of the acreage; class IV, 21 percent; class V, less than 0.5 percent; class VI, 24 percent; class VII, 2 percent; and class VIII, less than 0.5 percent. Because inadequate rainfall limits dryfarming, none of the soils are in class I.

The soils in this county range from nearly level to very steep. About 25 percent are nearly level, 32 percent are very gently sloping, 18 percent are gently sloping, and 14 percent are strongly sloping. About 9 percent are moderately steep, and 2 percent are very steep.

Most of the soils in the county are loamy or sandy. A few in the northern part of the county are clayey. The major soils on the uplands are loamy. These formed in residuum weathered from Tertiary sandstone and in locally wind-deposited material derived from fine-grained siltstone and sandstone. Minor soils in the uplands formed in eolian sand or alluvium. Soils in the valleys formed mainly in alluvium or a combination of colluvium and alluvium. Wetness from the seasonal high water table and alkalinity are the principal limitations of soils on

the bottom lands. Flooding is a hazard in some areas. The alkalinity, wetness, and fertility of the soils and the hazard of soil blowing are the principal concerns of management on the valley soils. Soil blowing and water erosion are the main hazards on upland soils. The annual precipitation is near the minimum for dryland cropping. Conserving moisture, controlling soil blowing, and maintaining soil fertility are other concerns of management.

In Box Butte County, about 53 percent of the agricultural land is cropland and about 46 percent is rangeland. The rest is in woodland, farm roads, water, and waste areas. About 54 percent of the cropland is dryfarmed, and about 24 percent is irrigated.

The first soil survey of Box Butte County was published in 1918 (*6*). This survey updates the first survey and gives additional information and maps that show the soils in more detail.

General Nature of the Survey Area

This section provides information about Box Butte County. It discusses history and development; physiography, relief, and drainage; geology; water supply; climate; industry, manufacturing, and agricultural business; and trends in agriculture.

History and Development

The Cheyenne and Sioux Indians were the first known inhabitants of what is now Box Butte County. Around 1880, the area was occupied by cattlemen who made use of the open range. The first large migration of settlers across the county occurred in 1878 with the opening of the Sydney-Deadwood Trail, a supply line for the gold mines of the Black Hills. The area was surveyed in 1879 and opened for settlement in 1880. Nonpareil, the first village in the county, was established about this time. The first settlers, who came mainly from other parts of Nebraska and from the eastern states and were mainly of German nationality, established their homesteads along the Niobrara River.

Box Butte County was formed from the southern part of Dawes County in 1886. Nonpareil was named the county seat. Later the county seat was moved to Hemingford. The town of Alliance was established in 1888 and became the county seat in 1898.

In 1890, this county had 5,570 inhabitants. The population climbed steadily, reaching 11,861 in 1930. From 1930 to 1970 the population fluctuated from a high of 12,270 in 1950 to a low of 10,094 in 1970. Since the revival of the coal industry in the early 1970's, railroad employment in Alliance has grown dramatically, increasing the population of the county to 13,696 in 1980.

Physiography, Relief, and Drainage

Box Butte County is in the High Plains section of the Great Plains physiographic province. Five general types of landforms make up the county—a high plains table, a rolling plain, an area of steep hills and escarpments, sandhills, and stream valleys.

The Box Butte Table dominates the north-central and central parts of the county and is a remnant of an ancient high plain. It is a broad, somewhat flat tableland that is dissected by entrenched drainageways. It slopes to the east and southeast. This table is capped by loess in most places.

To the west, south, and east of this tableland is a rolling plain. It consists of eroded remnants of the ancient high plains, which have been mantled in many places by wind-deposited coarse, moderately coarse, and loesslike materials. On the steeper slopes the underlying bedrock is commonly at or near the surface.

In the northern part of the county, rugged escarpments, hills, and steep side slopes were formed by the deep entrenchment of the Niobrara River and its tributaries. The area is largely made up of eroded material from Tertiary sandstone and has outcrops of Tertiary sandstone and clayey siltstone at the surface in many places. The bottom land of the Niobrara River lies from 100 to 200 feet below the higher hills and escarpments.

Along the southern and eastern borders of the county there are areas of rolling and hilly sand dunes. The tops of the higher dunes are 50 to 200 feet above the valley floor.

About 9 percent of the county is in stream valleys. The principal valleys are those of the Niobrara River and Snake Creek. The Niobrara River Valley ranges from 1/8 to 1/2 mile in width, and Snake Creek ranges from 1/8 mile to 3 miles in width.

This county is drained by four major systems. In the north, the Niobrara River and its tributaries, Dry Creek and Sand Canyon Creek, drain about 12 percent of the county. The Niobrara River enters the county in the northwestern corner and flows north out of the county about 8 miles east of the western border. Dry Creek and Sand Canyon Creek are intermittent streams. They run in a west to east direction, leaving the county about 11 miles west of the northeastern corner and entering the Niobrara River in southern Dawes County.

The northeastern part of the county is drained by Box Butte Creek. This creek is a perennial stream near the eastern border of the county. It flows in a northeasterly direction and leaves the county about 10 miles south of the northeastern corner. It enters the Niobrara River in western Sheridan County. This system drains about 15 percent of the county.

The east-central part of the county is drained by two intermittent streams, Berea Creek and Hemingford Creek. These creeks begin in the central part of the

county and drain in a southeasterly direction, terminating near the eastern border of the county into large basins where the water stands until it evaporates or soaks into the ground. These streams drain about 15 percent of the county.

The remainder of the county is drained by Snake Creek and its tributaries, chiefly Point of Rocks Creek and Barrel Springs Creek. Snake Creek runs in an easterly direction in the southern part of the county. It is a perennial stream in the western part of the county but loses its streamflow as it moves east across the county. Point of Rocks Creek and Barrel Springs Creek tributaries are intermittent streams that begin in the central and western parts of the county and drain in a southeasterly direction into Snake Creek. Snake Creek terminates near the eastern border of the county at the edge of the sandhills. Any drainage water that reaches the eastern part of the county is absorbed rapidly by the sandy soils.

The sandhill region, about 4 percent of the county, has no surface drainage, because the soils are so permeable they normally absorb all the precipitation that falls.

Box Butte County has an average elevation of 4,200 feet above sea level. It ranges from 4,580 feet near the west-central border of the county to 3,850 feet at the termination point of Hemingford Creek and Berea Creek. The Alliance airport is at an elevation of 3,930 feet, and the town of Hemingford is at an elevation of 4,256 feet.

Geology

Outcrops of bedrock in Box Butte County are of Tertiary age (*3*). The soils of Box Butte County formed in material weathered from this rock and from unconsolidated younger deposits of Quaternary age.

The oldest geologic exposures in the county are of the Arikaree Group. The lower part of this group consists of light-colored, fine-grained, massive sandstone and brownish sandy siltstone. The upper part of the Arikaree Group, known as the Upper Harrison Formation, consists of very fine- and fine-grained, grayish brown, loosely consolidated sandstone interbedded with white, calcareous sandstone ledges.

Outcrops of the lower Arikaree Group are along the Niobrara River in the northwestern part of the county and are at or near the surface throughout most of the southwestern part. Exposures of the Upper Harrison Formation are throughout much of the west-central part of the county.

Formations of the Ogallala Group are over the Arikaree Group in the county. Four formations are within this group. They are the Runningwater, Box Butte, Sheep Creek, and Ogallala Formations.

The Runningwater Formation fills an ancient stream valley running east to west across the northern part of the county. The formation is mostly composed of massive sandstone and wavy bedded sandstone. The color varies from pale yellow to light brownish gray and white.

The Box Butte Formation is over the Runningwater Formation in the northern part of the county and the Upper Harrison Formation in the north-central and east-central parts. The upper part of the formation is composed of reddish to greenish mottled claystone or clayey siltstone that has hard, white calcareous concretions. The lower part is composed of reddish clayey siltstone and fine-grained sandstone (*4*). Outcrops of this formation are in the northern part of the county. Norrest and Imlay soils formed in material weathered from the Box Butte Formation. The Hemingford soils formed in reworked material of this formation and are in the northeast part of the county.

The Sheep Creek Formation is over the Box Butte Formation in much of the northern and east-central parts of the county and is over the lower Arikaree Formation in the southwest corner. It is composed of greenish to grayish, soft sandstone that has calcareous, cemented sandstone ledges that are irregularly spaced throughout the formation. Most exposures are in the northern part of the county.

The Ogallala Formation is over the Arikaree Group in the south-central and southeastern parts of the county. It is composed of grayish or white cemented sandstone. Most of this formation is exposed in the south-central part of the county.

The unconsolidated Quaternary deposits are over the Tertiary formations throughout the county, except where these older formations are exposed at the surface. Most of the Quaternary deposits are wind-deposited loamy and sandy materials or loamy alluvium.

Soils that formed in deep, wind-deposited loamy materials are those of the Jayem and Keith series. Tassel soils formed in material weathered from the Tertiary sandstone formations. Alliance soils formed in a thin layer of loess deposited over material weathered from the underlying Tertiary bedrock. Soils that formed in deep deposits of eolian sand are in the Dailey, Valent, and Valentine series. Soils that formed in loamy alluvium are in the Craft, Duroc, Janise, and McCook series.

Water Supply

There are four main hydrologic units (subdivisions of geologic groups) in Box Butte County that are presently used for water supply and have potential for further development. These are the Arikaree and Upper Harrison units (Arikaree geologic group) and the Runningwater and Ogallala units (Ogallala geologic group). The water-bearing rocks in these units are mainly fine- and very fine-grained sandstones.

The Arikaree unit has a maximum thickness of 500 feet. It underlies most of the county and may be over 400 feet below the surface in the eastern part. This is the major water producing layer in the county. This unit

has approximately 115 million acre-feet of saturated rock, of which 20 percent (23 million acre-feet) is water.

The Upper Harrison unit has a maximum thickness of 200 feet. It is exposed in the west-central part of the county but is nearly 250 feet below the surface in the eastern part. This unit has approximately 30 million acre-feet of saturated rock. This rock contains 4.5 million acre-feet of water (15 percent of the volume).

The Runningwater unit has a thickness of over 200 feet. It has 6 million acre-feet of saturated rock, of which 20 percent (1.2 million acre-feet) is water.

The Ogallala unit is under most of the southern and southeastern parts of the county. It has maximum thickness of 200 feet. It has about 14 million acre-feet of saturated rock, of which 26 percent (3.7 million acre-feet) is water.

Small amounts of land are irrigated from Kilpatrick Lake and the Niobrara River. Except for these few areas, all irrigation and municipal water in the county is pumped from wells.

Most well water has a mineral concentration of less than 500 milligrams per liter. It is generally a "hard, silica-calcium-bicarbonate type and suitable for most irrigation, stock, domestic, industrial, and municipal purposes" (*5*).

Between 1938 and 1975 approximately 700,000 to 800,000 acre-feet of water has been removed from ground water storage. This represents a decrease of less than 2 percent of the total storage volume. Water levels at and just north of Alliance have gone down 35 to 40 feet since 1938. There is, however, no area in the county in which the ground water supply is severely depleted.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Box Butte County is generally warm in summer with frequent hot days. In winter, periods of very cold weather are caused by arctic air moving in from the north or northeast. Cold periods alternate with milder periods that occur often when westerly winds are warmed as they move downslope. Most precipitation falls as rain during the warmer part of the year and is normally heaviest in late spring and early summer. Winter snowfalls are frequent, but snow cover usually disappears during mild periods.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at the University of Nebraska Northwest Agriculture Laboratories at Alliance, in the period 1951 to 1977. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 26 degrees F, and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Box Butte on January 20, 1963, is -30 degrees. In summer the average temperature is 69 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Box Butte on July 12, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 15.12 inches. Of this, 12 inches, or 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 10 inches. The heaviest 1-day rainfall during the period of record was 2.18 inches at Alliance on August 10, 1974. Thunderstorms occur on about 44 days each year, and most occur in summer.

The average seasonal snowfall is 35 inches. The greatest snow depth at any one time during the period of record was 15 inches. On an average of 24 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 45 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 75 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the west or west-northwest during the months of October through April and from the east-southeast from May through September. Average windspeed is highest, 12 miles per hour, in spring.

During winter in some years, a heavy blizzard with high winds and drifting snow strikes the area, and snow remains on the ground for many weeks. During summer in some years, hailstorms cause severe local damage to crops in the area.

Commerce, Industry, and Agricultural Business

Most of the commerce of Box Butte County is associated with the railroad located in Alliance. In addition to the extensive facilities in the railroad yards, there are several railroad contractors and two maintenance plants.

Two firms in Alliance manufacture products for sale outside the county. One firm manufactures rubber hose products. The other firm makes down-filled products, such as clothing and sleeping bags. Many businesses sell and service machinery used in farming.

Fattened cattle, hogs, and sheep are shipped to adjacent counties or to large terminals for marketing. Poultry products produced on the farm are marketed mainly in the county. Grain products not used on the

farm are sold at local elevators and shipped to the larger grain terminals. Crops such as dry edible beans, sugar beets, and potatoes are marketed locally and then shipped out to the county to buyers and processors.

Trends in Agriculture

Farming has been a major part of the economy in Box Butte County since 1885. Before this, ranching was the main enterprise. According to Nebraska Agricultural Statistics, the number of farms in the county was 640 in 1963 and 570 in 1979. This gradual decline in numbers is caused mostly by an increase in the size of farms. The average size of farms in 1979 was approximately 800 acres. Farms in the county are mostly combination cash grain and livestock enterprises. Crop production has increased as more and more of the rangeland has been broken for cultivation and as more land has come under irrigation. Although rangeland has decreased, the number of cattle has increased through the years, mainly because more cattle are fattened in dry feedlots.

According to the Nebraska Agricultural Statistics reports, the total number of cattle increased from 49,000 in 1968 to 53,000 in 1978. The number of milk cows has decreased from 540 in 1968 to 200 in 1978. Hogs increased from 4,710 in 1968 to 4,900 in 1979. Sheep on farms decreased from 7,700 in 1968 to 1,600 in 1978, and the number of poultry decreased from 17,750 in 1968 to 5,000 in 1978.

Dryland wheat is the most important cultivated crop grown in the county. In 1968, 118,040 acres was planted to wheat; by 1978, the acreage had decreased to 103,000. During this time the average yield of wheat increased from 30.9 to 39.6 bushels per acre.

The use of irrigation has increased from 50,400 acres in 1968 to 86,000 acres in 1978. The main irrigated crops are corn, dry edible beans, and sugar beets. Irrigated corn has become an important cash-grain crop. In 1968, the crop was harvested from 11,680 acres, and by 1978, the acreage had increased to 21,200. The acreage of dry edible beans increased from 8,860 acres in 1968 to 26,500 acres in 1978. Production of sugar beets increased from 11,110 acres in 1968 to 14,800 acres in 1978.

Other crops grown in the county are alfalfa, oats, and potatoes, and most of the alfalfa and potatoes are under irrigation. Alfalfa is generally grown for hay production.

Most of the increase in crop yields can be accounted for by the use of commercial fertilizer and increased acreages under irrigation. From 1965 to 1966, 1,428 tons of commercial fertilizer was applied, and by 1978, the amount had increased to 16,986 tons. The number of irrigation wells increased from 338 in 1968 to about 707 in 1978.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind or segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparision to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could

confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soil in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation to precisely define and locate the soils is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each soil association on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Association Descriptions

Loamy, deep and moderately deep soils; on uplands

Two associations are in this group. The soils are deep and moderately deep, nearly level to steep, and well drained. Most of the acreage of the soils in this group is used for dryland farming. An important part of the acreage is irrigated, however, and both the center-pivot type of sprinkler system and the gravity system are used. A small part of the acreage, mainly on the steeper slopes along drainageways, is in native grass and used for grazing. Soil blowing and water erosion are the principal hazards. Maintaining fertility and controlling erosion are the main management concerns in cultivated areas. Regulating the timing and intensity of grazing is the principal concern on rangeland.

1. Alliance-Rosebud-Keith Association

Deep and moderately deep, nearly level to steep, well drained, loamy soils; on uplands

This association is on an upland landscape consisting of broad flats and ridgetops and side slopes along intermittent drainageways (fig. 2).

This association covers about 258,000 acres, or about 37.7 percent of the county. It is about 39 percent Alliance soils, 18 percent Rosebud soils, 18 percent Keith soils, and 25 percent soils of minor extent.

Alliance soils are on broad flats, wide ridgetops, and side slopes. These deep, well drained soils are nearly level to strongly sloping. Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is pale brown, friable silt loam. The underlying material is light gray and pale brown, calcareous very fine sandy loam and loam. At a depth of about 46 inches is white, weakly cemented, limy sandstone.

Rosebud soils are on ridgetops, side slopes, and flats. These moderately deep, well drained soils are nearly level to steep. Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is grayish brown, firm clay loam, and the lower part is light brownish gray, friable loam. The underlying material is light gray, calcareous very fine sandy loam that has many small sandstone fragments. At a depth of about 35 inches is white, weakly cemented, limy sandstone.

Keith soils are on smooth flats and on side slopes. These deep, well drained soils are nearly level to gently sloping. Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown, friable silty clay loam; the middle part is brown, friable silt loam; and the lower part is very pale brown, friable, calcareous silt loam. The underlying material to a depth of 60 inches or more is very pale brown and white, calcareous very fine sandy loam.

Of minor extent in this association are Canyon, Craft, Creighton, Duroc, Hemingford, and Richfield soils. The shallow, gently sloping to steep Canyon soils are on ridgetops and side slopes of the uplands. Craft soils are on bottom lands of narrow drainageways. The nearly level to strongly sloping Creighton soils are on uplands. Duroc soils are on foot slopes and concave areas of the uplands. The nearly level to gently sloping Hemingford soils are on flats and side slopes of the uplands. The nearly level Richfield soils are on uplands.

Farms in this association are cash-grain operations or a combination of cash-grain and livestock operations. Wheat is the principal dryland crop. Irrigation is important. Corn, sugar beets, field beans, and alfalfa are important irrigated crops, and potatoes are a minor irrigated crop. Areas of the steep soils adjacent to the

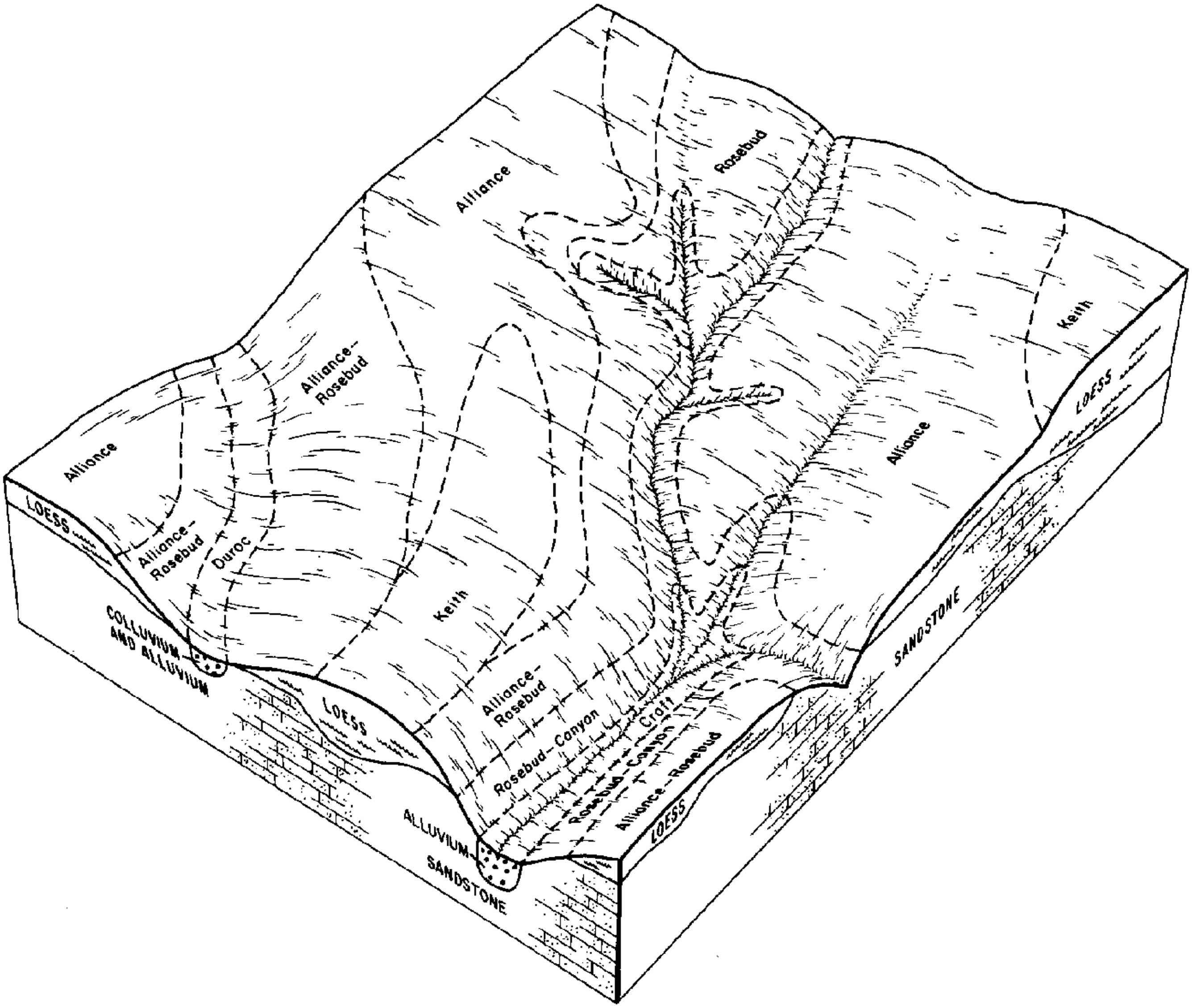

Figure 2.—Typical pattern of soils and underlying material in the Alliance-Rosebud-Keith association.

upland drainageways are generally in grass and are used for range. Some livestock are fattened for market.

Soil blowing is the main hazard on the broad, flat areas if the surface is unprotected. Soil blowing and water erosion are hazards on the more sloping areas. A lack of adequate rainfall generally limits the selection of crops that can be successfully grown under dryland farming. Maintaining fertility and controlling erosion are the main management concerns on cultivated soils. A declining ground water level is a concern where crops are irrigated. Regulating the timing and intensity of grazing is the main concern on rangeland.

Farms in this association average about 640 acres. Wells provide sufficient water for livestock and domestic use. Most of the cash-grain crops are marketed within the county at local elevators. Sugar beets are delivered to weighing stations. Cattle and swine are the main livestock, and most of these are marketed outside the county at local sale barns or at larger terminal markets. Roads surfaced with crushed rock or improved dirt roads along most section lines provide adequate avenues to markets.

2. Alliance-Hemingford-Satanta Association

Deep, nearly level to strongly sloping, well drained, loamy soils; on uplands

This association mainly is on an upland landscape consisting of broad, smooth flats and low ridges and of side slopes along intermittent drainageways.

This association covers about 32,000 acres, or about 5.2 percent of the county. It is about 33 percent Alliance soils, 24 percent Hemingford soils, 12 percent Satanta soils, and 31 percent soils of minor extent.

Alliance soils are on flats and side slopes. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is pale brown, friable silt loam. The underlying material is light gray and pale brown, calcareous very fine sandy loam and loam. At a depth of about 46 inches is white, weakly cemented, limy sandstone.

Hemingford soils are on flats and on a few side slopes. These well drained soils are nearly level to gently sloping. Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, firm clay loam, and the lower part is light brownish gray, firm, calcareous sandy clay loam. The underlying material is light gray, calcareous sandy clay loam. At a depth of about 42 inches is white, weakly cemented, limy sandstone.

Satanta soils are on ridges, flats, and side slopes of the uplands. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is 24 inches thick. The upper part is grayish brown, very friable fine sandy loam; the middle part is grayish brown, friable loam; and the lower part is pale brown, friable, calcareous loam. The underlying material to a depth of 60 inches or more is very pale brown, calcareous loam and very fine sandy loam.

Of minor extent in this association are mainly the Busher, Duroc, Jayem, Keith, Manter, and Rosebud soils. Busher and Jayem soils are on ridgetops and short side slopes of the uplands. Duroc soils are on foot slopes and on bottoms of drainageways and in concave areas of the uplands. The nearly level to gently sloping Keith and Rosebud soils are on uplands. Manter soils are on low ridges and on a few smooth flats of the uplands.

Farms in this association are mostly cash-grain operations. A few farms are a combination of cash-grain and livestock enterprises. Winter wheat is the main dryland crop. Corn, field beans, and alfalfa are the principal irrigated crops. Areas of some of the strongly sloping soils bordering drainageways are in grass and used for grazing. Some cattle and swine are fattened for market.

Soil blowing is the principal hazard in this association. Water erosion is also a hazard in the gently sloping and strongly sloping areas. The average annual rainfall commonly limits the growth and selection of crops that can be successfully grown under dryland farming. Controlling erosion and maintaining fertility are the most important management concerns. A declining ground water level is a concern where crops are irrigated. Regulating the timing and intensity of grazing is the principal concern on rangeland.

Farms in this association average about 640 acres. Wells provide sufficient water for livestock and domestic use. Most of the cash-grain crops are marketed within the county at local elevators. Most of the livestock are marketed outside the county at local sale barns or at larger terminal markets. Improved dirt roads and some roads surfaced with crushed rock along most section lines provide adequate avenues for farm uses.

Loamy, deep, moderately deep, and shallow soils; on uplands

Two associations are in this group. The soils are deep, moderately deep, and shallow, nearly level to steep, and well drained. About 60 percent of the acreage of this group is used for dryland farming. A small part of the acreage is irrigated, mainly by the center-pivot type of sprinkler system. Most of the acreage in the steep areas and along deeply entrenched drainageways is in native grass and is used for grazing. Soil blowing and water erosion are the principal hazards. Controlling erosion and maintaining or increasing fertility are the main concerns of management in the cultivated areas. Regulating the timing and intensity of grazing is the principal concern on rangeland.

3. Norrest-Canyon-Creighton Association

Deep, moderately deep, and shallow, gently sloping to steep, well drained, loamy soils; on uplands

This association is on an upland landscape in the Dry Creek Watershed. Most of the soils are strongly sloping to steep.

This association covers about 16,000 acres, or about 2.3 percent of the county. It is about 24 percent Norrest soils, 20 percent Canyon soils, 14 percent Creighton soils, and 42 percent soils of minor extent.

Norrest soils are on the upper part of smooth, moderately long side slopes and are also on some breaks. These moderately deep, well drained soils are strongly sloping to steep. Typically, the surface layer is grayish brown, friable, calcareous loam about 4 inches thick. The subsoil is firm, calcareous clay loam about 17 inches thick. The upper part is grayish brown, and the lower part is light brownish gray. At a depth of about 21 inches is very pale brown, calcareous clayey siltstone.

Canyon soils are on rough, short side slopes. These shallow, well drained soils are mainly strongly sloping to steep. Typically, the surface layer is dark grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The next layer is grayish brown, very friable,

calcareous very fine sandy loam about 3 inches thick. The underlying material is light gray, calcareous very fine sandy loam with many small fragments of sandstone. Below this, at a depth of about 14 inches, is white, weakly cemented, limy sandstone.

Creighton soils are on smooth, moderately long side slopes. These deep, well drained soils are mainly gently sloping to steep. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsoil is very friable very fine sandy loam about 12 inches thick. The upper part is brown, and the lower part is grayish brown. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous very fine sandy loam.

Of minor extent in this association are mainly the Alliance, Duroc, Oglala, Rosebud, and Valent soils. The very gently sloping to gently sloping Alliance soils are on the lower side slopes and ridgetops of the uplands. Duroc soils are on the foot slopes. The gently sloping to steep Oglala soils are on the lower side slopes of the uplands. The moderately deep Rosebud soils are on the ridgetops and the lower side slopes of the uplands. The sandy Valent soils are in undulating areas along the lower parts of drainageways.

Farms and ranches in this association are mainly in native grass and used for grazing. Most of the acreage is used for beef cow-calf operations. The soils on a few of the ridgetops and in the less sloping areas are cultivated, and dryland wheat and alfalfa are the main crops.

Water erosion is the principal hazard on these slopes. In addition, soil blowing is a hazard in the cultivated areas. Lack of rainfall generally limits the production of both grass and cultivated crops. A restrictive layer in the Norrest and Canyon soils limits root growth and available water capacity for grass and crops. Regulating the timing and intensity of grazing and improving the range condition are the main concerns on rangeland. The main management concerns in cultivated areas are controlling erosion and maintaining or increasing fertility.

Farms and ranches in this association average about 960 acres. Wells provide sufficient water for livestock and domestic use. Nearly all of the owners and operators reside on land that is outside this association. Cattle are marketed outside the county at local sale barns or at larger terminal markets. The small amount of cash-grain crops is marketed locally. A few roads surfaced with crushed rock or dirt are along section lines.

4. Creighton-Oglala-Canyon Association

Deep and shallow, nearly level to steep, well drained, loamy soils; on uplands

This association is on an upland landscape consisting of narrow ridgetops, on tablelands of the uplands, and on smooth side slopes along intermittent upland drainageways (fig. 3).

This association covers about 82,000 acres, or about 12 percent of the county. It is about 46 percent Creighton soils, 13 percent Oglala soils, 10 percent Canyon soils, and 31 percent soils of minor extent.

Creighton soils are on tablelands and on moderately long side slopes of the uplands. These deep, well drained soils are nearly level to strongly sloping. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsoil is very friable very fine sandy loam about 12 inches thick. The upper part is brown, and the lower part is grayish brown. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous very fine sandy loam.

Oglala soils are on side slopes and ridgetops. These deep, well drained soils are gently sloping to steep. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The next layer is brown, very friable very fine sandy loam about 14 inches thick. The underlying material is light gray, calcareous very fine sandy loam. At a depth of about 53 inches is white, weakly cemented, limy sandstone.

Canyon soils are on ridgetops and the upper part of side slopes. These shallow, well drained soils are gently sloping to steep. Typically, the surface layer is dark grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The next layer is grayish brown, very friable, calcareous very fine sandy loam about 3 inches thick. The underlying material is light gray, calcareous very fine sandy loam with many small fragments of sandstone. Below this, at a depth of 14 inches, is white, weakly cemented, limy sandstone.

Of minor extent in this association are mainly the Alliance, Bridget, Busher, Jayem, Keith, and Tassel soils. The nearly level to gently sloping Alliance and Keith soils are on the wide ridgetops of the uplands. Bridget soils are on foot slopes and stream terraces. The nearly level to steep Busher soils are on smooth side slopes and ridges of the uplands. The nearly level to strongly sloping Jayem soils are on smooth side slopes and on ridgetops of the uplands. The shallow, gently sloping to steep Tassel soils are on side slopes of the uplands.

Farms in this association are either cash-grain operations or a combination of cash-grain and livestock operations. Winter wheat is the main crop under dryland management. Corn, sugar beets, field beans, and alfalfa are the main irrigated crops. The areas of steeper soils and the more dissected areas are in native grass and are used for grazing. Some livestock are fattened in drylots for market.

Soil blowing is the principal hazard on the nearly level to gently sloping soils that are farmed. Both water erosion and soil blowing are hazards on the more sloping soils that are unprotected. Inadequate summer rainfall generally limits the growth and selection of crops that can be successsfully grown under dryland management. A restricted root zone limits the available

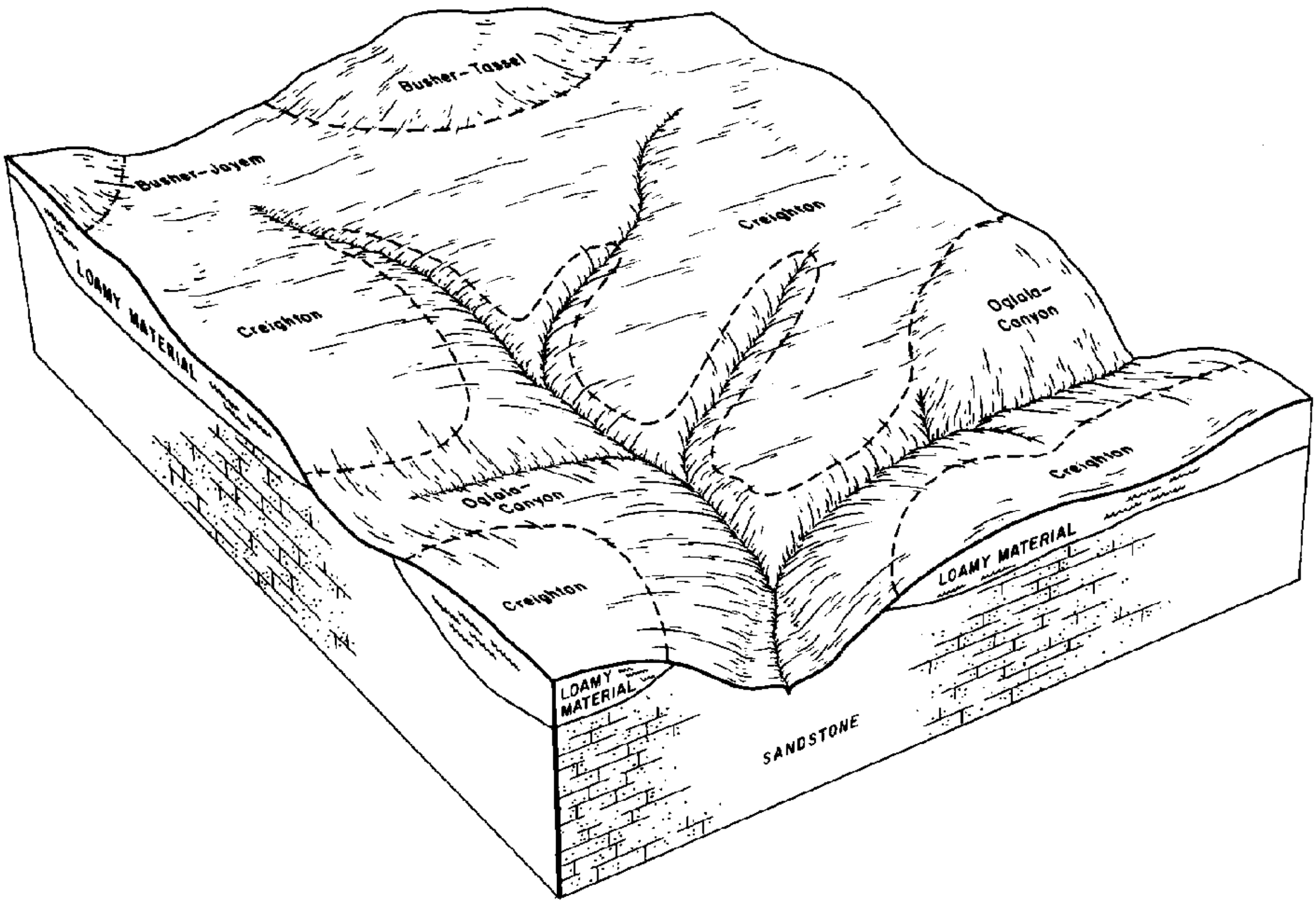

Figure 3.—Typical pattern of soils and underlying material in the Creighton-Oglala-Canyon association.

water capacity in some areas and lowers production of crops. Maintaining or increasing fertility and controlling erosion are the principal concerns of management in the farmed areas. A declining ground water level is a concern where crops are irrigated. Regulating the timing and intensity of grazing and improving the range condition are the principal concerns on rangeland.

Farms in this association average about 640 acres. Wells generally provide sufficient water for livestock and domestic use. Most of the cash-grain crops are marketed within the county. Sugar beets are delivered to weighing stations within the county. Cattle are the principal livestock, and some swine are also raised. Most cattle and swine are marketed outside the county at local sale barns or at larger terminal markets. Roads surfaced with crushed rock, improved dirt roads, and paved roads are on many section lines.

Sandy, deep and shallow soils; on uplands

Only one association is in this group. The soils are deep and shallow, nearly level to very steep, and well drained and excessively drained. Most of the acreage of this group is in rangeland use. A minor part of the acreage is cultivated. Most of this is used for dryland farming, but a small part is irrigated, mainly by the center-pivot type of sprinkler system. Soil blowing and water erosion are the principal hazards. Regulating the timing and intensity of grazing and improving the range condition are the principal concerns on rangeland. Controlling soil blowing and increasing fertility are the main concerns in the cultivated areas.

5. Busher-Valent-Tassel Association

Deep and shallow, nearly level to very steep, well drained and excessively drained, sandy soils; on uplands

This association is on an upland landscape consisting of breaks, hummocks, and ridges and on side slopes adjacent to upland drainageways. Most of the intermittent drainageways are tributaries of the Niobrara River.

This association covers about 57,000 acres, or about 8.3 percent of the county. It is about 27 percent Busher soils, 24 percent Valent soils, 14 percent Tassel soils, and 35 percent soils of minor extent.

Busher soils are on smooth side slopes and ridges between upland drainageways. These deep, well drained soils are nearly level to steep. Typically, the surface layer is grayish brown, very friable loamy very fine sand about 11 inches thick. The subsoil is brown, very friable loamy very fine sand about 12 inches thick. The underlying material is calcareous loamy very fine sand. The upper part is pale brown, and the lower part is light gray. At a depth of about 56 inches is white, weakly cemented, limy sandstone.

Valent soils are on hummocks and smooth side slopes of sandhills. These deep, excessively drained soils are nearly level to moderately steep. Typically, the surface layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is brown fine sand.

Tassel soils are on ridgetops, breaks, and the upper part of side slopes that border intermittent drainageways of the uplands. These shallow, well drained soils are nearly level to very steep. Typically, the surface layer is grayish brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material is light gray, calcareous loamy very fine sand that has many small sandstone rock fragments. At a depth of 18 inches is white, weakly cemented, limy sandstone.

Of minor extent in this association are mainly the Bridget, Creighton, Imlay, Jayem, Oglala, and Vetal soils. Bridget soils are on foot slopes and stream terraces. Creighton soils are on side slopes of the uplands. The moderately steep to very steep Imlay soils are on side slopes of the uplands. The nearly level to strongly sloping Jayem soils are on uplands. The gently sloping to steep Oglala soils are on side slopes of the uplands. Vetal soils are on foot slopes in the upland swales.

This association is mainly in native grass and is used for grazing. Most of the association is used for the beef cow-calf type of operation. Areas of some of the less sloping soils and a few areas in the Niobrara River Valley are farmed. Winter wheat is the main dryland crop, and corn and alfalfa are the main irrigated crops.

Water erosion is the principal hazard in rangeland areas, and soil blowing is the principal hazard in cultivated areas. Lack of adequate summer rainfall generally limits the growth of grass and cultivated crops. A restrictive layer in some soils limits root growth and the available water capacity for grass and crop production. Regulating the timing and intensity of grazing and improving the range condition are the principal concerns on rangeland. Controlling soil blowing and improving fertility are the management concerns in the cultivated areas.

Farms and ranches in this association average about 2,000 acres. Many of the owners or operators reside on land outside this association. Wells provide sufficient water for livestock and domestic use. Cattle are the main livestock, and most are marketed outside the county at local sale barns or at larger terminal markets. Some of the yearling calves are sold direct to feeder buyers. The cash-grain crops are marketed locally. Very few improved roads are in this association. Trails provide access to most areas.

Loamy and sandy, deep soils; on uplands

Two assocations are in this group. The soils are deep, nearly level to strongly sloping, and well drained. About 60 percent of the acreage of this group is in rangeland and used for grazing. The remaining acreage is cultivated. Most of this is used for dryland farming, but a small part of this acreage is irrigated, mainly by the center-pivot type of sprinkler system. Soil blowing and water erosion are the main hazards. Regulating the timing and intensity of grazing and improving the range condition are the principal management concerns on rangeland. Controlling erosion and maintaining or improving fertility are the main concerns in cultivated areas.

6. Sarben-Busher Association

Deep, nearly level to strongly sloping, well drained, sandy soils; on uplands

This association is on an upland landscape consisting of long, smooth side slopes, low ridges, and short side slopes adjacent to upland drainageways (fig. 4). These intermittent drainageways are tributaries of Snake Creek.

This association covers about 48,000 acres, or about 7 percent of the county. It is about 48 percent Sarben soils, 38 percent Busher soils, and 14 percent soils of minor extent.

Sarben soils are on long, smooth side slopes and the ridges of the uplands. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is grayish brown, very friable loamy very fine sand about 3 inches thick. The next layer is grayish brown, very friable loamy very fine sand about 9 inches thick. The upper part of the underlying material is light brownish gray loamy very fine sand. The lower part to a depth of 60 inches or more is light gray, calcareous very fine sandy loam and loamy very fine sand.

Busher soils are on the ridges, the long, smooth side slopes, and the short side slopes along intermittent drainageways of the uplands. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is grayish brown, very friable loamy very fine sand about 11 inches thick. The subsoil is brown, very friable

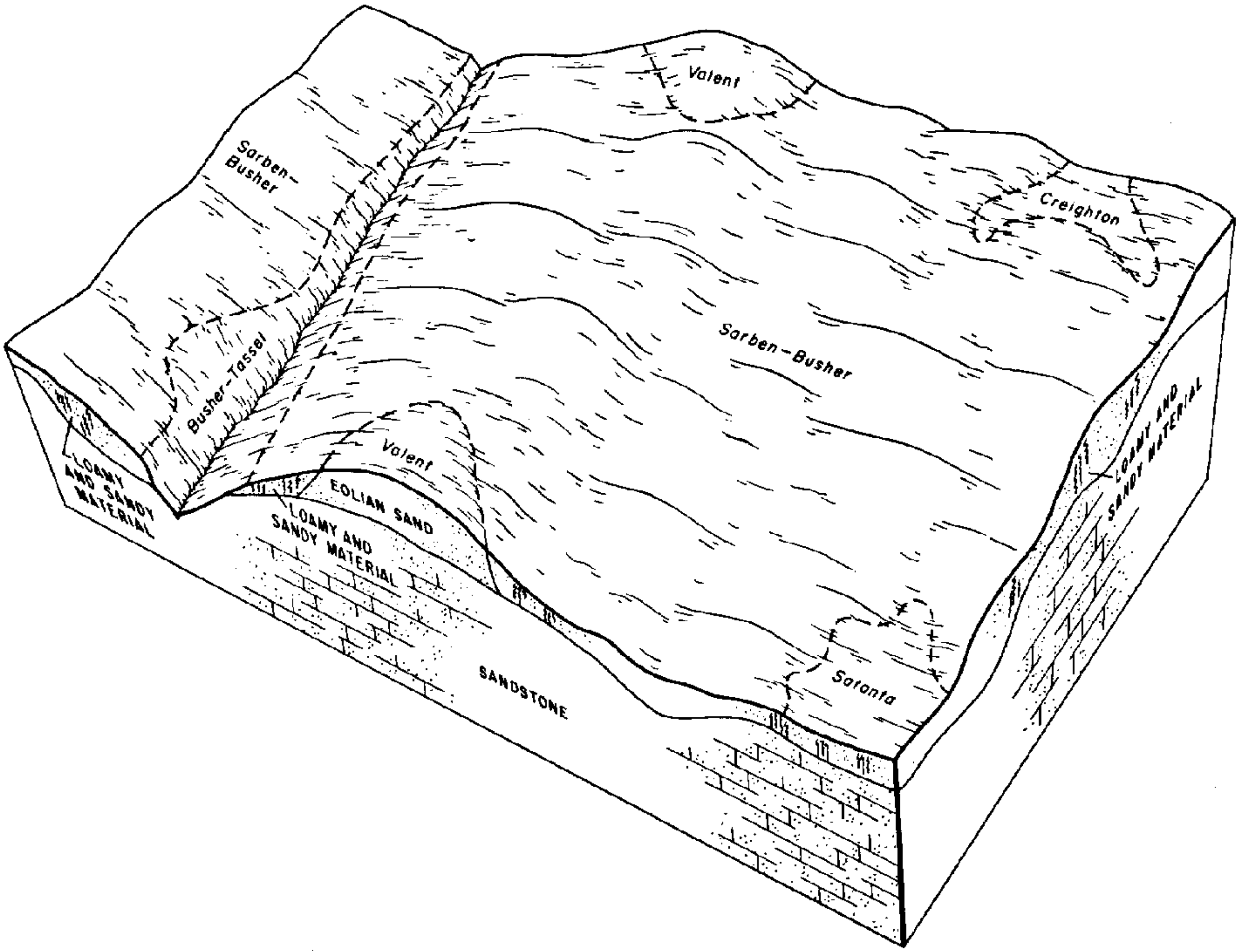

Figure 4.—Typical pattern of soils and underlying material in the Sarben-Busher association.

loamy very fine sand about 12 inches thick. The underlying material is calcareous loamy very fine sand. The upper part is brown, and the lower part is light gray. At a depth of 56 inches is white, weakly cemented, limy sandstone.

Of minor extent in this association are mainly the Creighton, Satanta, Tassel, and Valent soils. The nearly level to strongly sloping Creighton soils are on uplands. The very gently sloping Satanta soils are on uplands. Tassel soils are on ridgetops, breaks, and the upper part of side slopes surrounding drainageways of the uplands. The sandy Valent soils are on the hummocky and rolling landscape.

Nearly all of the farms and ranches in this association are in native grass and used for the beef cow-calf operation. A few areas are in irrigated corn, field beans, or alfalfa.

Soil blowing is the principal hazard, particularly where these soils are cultivated or in areas where the grass cover has been destroyed. Inadequate summer rainfall generally limits growth and production of the grasses. Regulating the timing and intensity of grazing and improving the condition of the grass are the main concerns on rangeland. Increasing fertility and controlling soil blowing are the principal concerns in cultivated fields.

Farms and ranches in this association average about 5,000 acres. Most of the owners and operators reside on land outside this association. Wells provide sufficient water for livestock and domestic use. Many of the cattle

are marketed outside the county at local sale barns or at larger terminal markets. Some yearlings are sold direct to feeder buyers. Cash-grain crops are marketed locally. Very few improved roads are in this association. Most areas are accessible only by trails.

7. Satanta-Jayem-Busher Association

Deep, nearly level to strongly sloping, well drained, loamy and sandy soils; on uplands

This association is on an upland landscape consisting of broad flats, low ridges, and smooth side slopes.

This association covers about 58,000 acres, or about 8.5 percent of the county. It is about 23 percent Satanta soils, 20 percent Jayem soils, and 15 percent Busher soils. The remaining 42 percent is soils of minor extent.

Satanta soils are on flats and short side slopes. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is 24 inches thick. The upper part is grayish brown, very friable fine sandy loam; the middle part is grayish brown, friable loam; and the lower part is pale brown, friable, calcareous loam. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam and very fine sandy loam.

Jayem soils are on flats, low ridges, and short side slopes. These well drained soils are nearly level to strongly sloping. Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is grayish brown, very friable very fine sandy loam about 15 inches thick. The underlying material is very fine sandy loam. The upper part is pale brown, and the lower part is light gray to a depth of 60 inches.

Busher soils are on flats, ridges, and long side slopes. These well drained soils are nearly level to strongly sloping, but included are a few steep areas on side slopes along drainageways or on hills. Typically, the surface layer is grayish brown, very friable loamy very fine sand about 11 inches thick. The subsoil is brown, very friable loamy very fine sand about 12 inches thick. The underlying material is calcareous loamy very fine sand. The upper part is pale brown, and the lower part is light gray. At a depth of about 56 inches is white, weakly cemented, limy sandstone.

Of minor extent in this association are mainly the Alliance, Creighton, Dailey, Keith, Tassel, Valent, and Vetal soils. The nearly level to strongly sloping Alliance soils are on side slopes and flats of the uplands. The nearly level to steep Creighton soils are on uplands. The nearly level to strongly sloping Dailey soils are on uplands. The nearly level to gently sloping Keith soils are on loess-covered uplands. The shallow Tassel soils are on ridgetops and on the upper part of side slopes of the uplands. The sandy Valent soils are on undulating and rolling sandhills. Vetal soils are in swales and on foot slopes.

Farms in this association are mainly a combination of cash-grain operations and livestock enterprises. Winter wheat is the main dryland crop. Corn, field beans, sugar beets, and alfalfa are the principal irrigated crops. Areas of most of the steeper soils and areas of sandy soils are in grass and are used for rangeland. Some livestock is fattened for market.

Soil blowing is the principal hazard, particularly where the soils are cultivated. Water erosion is also a hazard on unprotected surfaces of the steeper slopes. Lack of summer rainfall generally limits the selection of crops that can be successfully grown under dryland management. Maintaining or improving fertility and controlling erosion are the principal management concerns in farmed areas. A declining ground water level is a concern to farmers who irrigate crops. Regulating the timing and intensity of grazing and improving the condition of the grass are the principal concerns on rangeland.

Farms in this association average about 640 acres. Wells provide sufficient water for livestock and domestic use. Most of the cash-grain crops are marketed within the county at local elevators. Sugar beets are delivered to weighing stations within the county. Cattle are the main livestock, but some swine are also raised. Most of these are marketed outside the county at local sale barns or at larger terminal markets. Roads surfaced with crushed rock and improved dirt roads are along most section lines.

Sandy, deep soils; on uplands and sandhills

Two associations are in this group. The soils are deep, nearly level to very steep, and excessively drained and somewhat excessively drained. Most of the acreage of this group is in rangeland and used for grazing. A smaller part is cultivated, mainly for crops grown under the center-pivot type of sprinkler system. Soil blowing is the principal hazard on unprotected surfaces. Regulating the timing and intensity of grazing and improving the condition of the grass are the main concerns of management on rangeland. Improving fertility and controlling soil blowing are the main concerns in cultivated areas.

8. Valent-Dailey Association

Deep, nearly level to moderately steep, excessively drained and somewhat excessively drained, sandy soils; on uplands

This association is on sandhills consisting of hummocks and of smooth side slopes on hillsides (fig. 5).

This association occupies about 61,000 acres, or about 8.8 percent of the county. It is about 56 percent Valent soils, 27 percent Dailey soils, and 17 percent soils of minor extent.

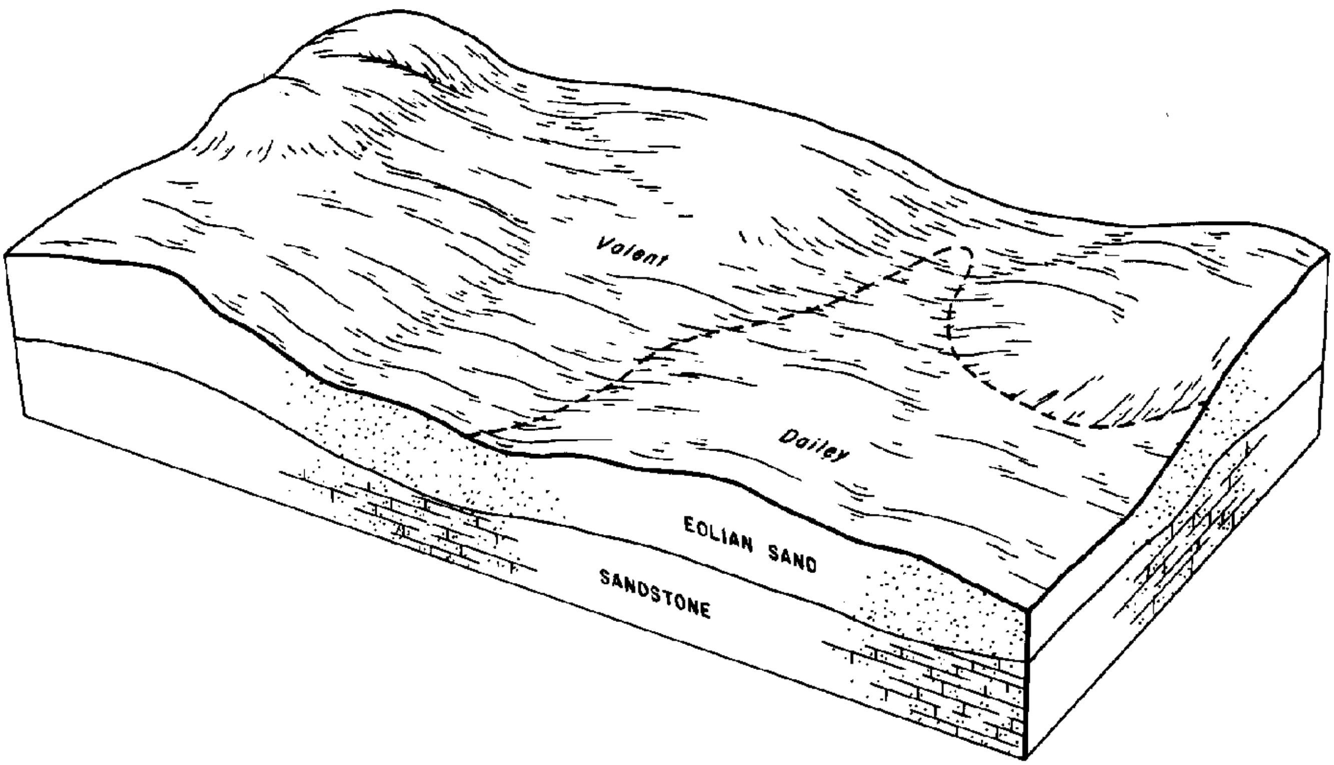

Figure 5.—Typical pattern of soils and the underlying material in the Valent-Dailey association.

Valent soils are on hummocks and side slopes. These excessively drained soils are nearly level to moderately steep. Typically, the surface layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is brown fine sand.

Dailey soils are on side slopes and hummocks. These somewhat excessively drained soils are nearly level to strongly sloping. Typically, the surface layer is very friable loamy sand about 15 inches thick. The upper part is grayish brown, and the lower part is dark grayish brown. The underlying material to a depth of 60 inches or more is pale brown loamy sand.

Of minor extent in this association are mainly the Busher, Ipage, Janise, Jayem, and Lisco soils. Busher soils are on the low ridges and on side slopes of the uplands. The moderately well drained Ipage soils are in the low concave areas of sandhills. The saline-alkali Janise soils are on bottom lands and in alluvial swales. The nearly level to strongly sloping Jayem soils are on uplands. The saline-alkali Lisco soils are on bottom lands or in alluviual swales and are somewhat poorly drained. The wet phase of Lisco soils, however, is not so strongly saline-alkali as the typical Lisco soil.

Farms and ranches in this association are mainly in native grass and used as rangeland. Most of the acreage is used for the beef cow-calf type of operation. Areas of some of the less sloping soils are farmed. The cultivated areas are generally irrigated, and corn and alfalfa are the main crops. Winter wheat is the principal dryland crop. Some of the livestock is fattened in the drylot for market.

Soil blowing is the principal hazard, particularly in areas where these soils are cultivated or in areas where the grass cover has been destroyed. These soils have low available water capacity, and the lack of adequate rainfall commonly limits the growth and production of dryfarmed crops and grass. Regulating the timing and intensity of grazing and improving the condition of the grass are the main concerns on rangeland. Improving fertility and controlling soil blowing are concerns on cultivated land.

Farms and ranches in this association average about 2,500 acres. Wells provide sufficient water for livestock and domestic use. Cattle are the main livestock. They are generally marketed outside the county at local sale barns or at large terminal markets. Some of the yearlings are sold direct to feeder buyers. The cash-grain crops are marketed locally. Very few improved roads are in this

association, and these are roads surfaced with crushed rock or dirt. Many areas are accessible only by trails.

9. Valentine Association

Deep, gently sloping to very steep, excessively drained, sandy soils; on sandhills

In this association the landscape consists mainly of hummocks and dunelike hills.

This association covers about 26,000 acres, or about 3.7 percent of the county. It is about 94 percent Valentine soils and 6 percent soils of minor extent.

Valentine soils are on hummocks and dunelike hills. Typically, the surface layer is grayish brown, loose fine sand about 3 inches thick. The next layer is brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand.

Of minor extent in this association are mainly Dailey, Hoffland, and Ipage soils. Dailey soils are in sandhill valleys and on some of the lower side slopes. The very poorly drained Hoffland soils are in valleys and depressions of the sandhills. Ipage soils are along the margin of sandhill valleys, are moderately well drained, and are alkali in the substratum.

Ranches in this association are nearly all in native grass and used as rangeland. This association is used for beef cow-calf operations. Only a few areas are farmed, and these are in irrigated alfalfa. A few livestock are fattened in the drylot for market.

Soil blowing is a severe hazard on unprotected surfaces. Low fertility, low available water capacity, and lack of adequate summer rainfall commonly limit the growth and production of the grass. Regulating the timing and intensity of grazing and improving the condition of the grass are the most important concerns.

Ranches in this association average about 4,000 acres. Wells provide sufficient water for livestock and domestic use. Most owners and operators live outside the association. Many of the yearling calves are sold direct to feeder buyers. The remaining market cattle are sold outside the county at local sale barns or at larger terminal markets. Most areas are accessible only by trails.

Loamy, deep soils; on bottom lands

The soils in this group are deep, nearly level, and somewhat poorly drained and poorly drained. Nearly all of the acreage of this group is in rangeland and used for grazing or mowed for hay. Wetness is the principal limitation. Regulating the timing and intensity of grazing and improving the range condition are the main concerns of management.

10. Las Animas-Lisco Association

Deep, nearly level, somewhat poorly drained and poorly drained, loamy soils; on bottom lands

This association consists mainly of soils on bottom lands in the Niobrara River Valley.

This association covers about 1,728 acres, or about 0.3 percent of the county. It is about 38 percent Las Animas soils, 37 percent Lisco soils, and 25 percent soils of minor extent.

Las Animas soils occupy smooth, slightly channeled bottom lands. These soils are somewhat poorly drained. Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The next layer is light gray, very friable, calcareous very fine sandy loam about 5 inches thick. The upper part of the underlying material is light gray and pale brown, calcareous loamy very fine sand and very fine sandy loam. The lower part to a depth of 60 inches or more is light gray fine sand.

Lisco soils occupy the flat lower lying areas on bottom lands. These soils are somewhat poorly drained and poorly drained. Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 5 inches thick. The subsoil is light brownish gray, very friable, calcareous loamy very fine sand about 5 inches thick. The upper part of the underlying material is light gray, mottled, calcareous loamy very fine sand and very fine sandy loam. The lower part to a depth of 60 inches or more is white, calcareous sand with a few pebbles. The soil is strongly alkaline in the surface layer and subsoil and is only mildly alkaline or moderately alkaline in the underlying material.

Of minor extent in this association are mainly the Bankard, Bridget, and Ipage soils. Bankard soils are somewhat excessively drained and are on bottom lands. The nearly level or very gently sloping Bridget and Ipage soils are on foot slopes or stream terraces.

This association is used mainly for ranching. Nearly all the acreage is in native grass, and most is mowed for hay. Most ranchers operate a beef cow-calf program. A few of the better drained soils are farmed, and corn and alfalfa are the crops grown. Some livestock is fattened for market.

Wetness is the main limitation of the soils in this association. The high water table makes field operations difficult during the spring. Strong alkalinity in many soil areas affects the growth and composition of plant species. Flooding is a hazard in most soil areas. Regulating the timing and intensity of grazing and improving the range condition are concerns of management. Wetness and alkalinity are the principal concerns in the cultivated areas.

This association takes in a small part of several ranches, each part averaging about 350 acres. The ranch headquarters are generally located on land outside this association. Water for livestock is available from the Niobrara River. Some of the yearling calves are sold direct to feeder buyers. The remaining cattle are sold outside the county at local sale barns or at larger terminal markets. Trails provide access.

Loamy and sandy, deep, saline-alkali soils; on bottom lands

The soils in this group are deep and nearly level and very gently sloping. They are moderately well drained, somewhat poorly drained, and poorly drained. Most of the acreage of this group is in rangeland and is used for grazing or mowed for hay. A small part of the acreage is cultivated, mainly under the center-pivot type of sprinkler system or gravity system. Alkalinity and wetness are the principal limitations. Regulating the timing and intensity of grazing and improving the condition of the grass are the main concerns of management on rangeland. Soil alkalinity and wetness are the main concerns in the cultivated areas.

11. Janise-Lisco Association

Deep, nearly level and very gently sloping, moderately well drained, somewhat poorly drained, and poorly drained, loamy and sandy, saline-alkali soils; on bottom lands

This association consists mainly of soils on bottom lands, most of which are flat or slightly channeled and are in the Snake Creek Valley.

This association covers about 42,000 acres, or about 6.2 percent of the county. It is about 61 percent Janise soils, 13 percent Lisco soils, and 26 percent soils of minor extent.

Janise soils are on flat or slightly channeled bottom lands. These soils are nearly level or very gently sloping and are moderately well drained or somewhat poorly drained. Typically, the surface layer is gray, very friable, calcareous loam, but in some areas, loamy fine sand, 8 to 20 inches thick is overblown on the surface. The subsoil is light brownish gray, calcareous, and about 12 inches thick. The upper part is friable silt loam, and the lower part is very friable loam. The underlying material to a depth of 60 inches or more is light gray, calcareous loam and very fine sandy loam. The soil is very strongly alkaline in the upper part and strongly alkaline in the lower part.

Lisco soils are on the flat bottom lands. These nearly level soils are somewhat poorly drained and poorly drained. Typically, the surface layer is grayish brown and light grayish brown, calcareous very fine sandy loam about 5 inches thick. The subsoil is about 11 inches thick. It is light brownish gray, calcareous, and very friable. The upper part is very fine sandy loam, and the lower part is loamy very fine sand. The upper part of the underlying material is light brownish gray, calcareous loamy very fine sand, and the lower part to a depth of 60 inches or more is gray and light gray, calcareous loam and very fine sandy loam. Typically, the soil is very strongly alkaline in the upper part and strongly alkaline in the lower part.

Of minor extent in this association are mainly the Craft, Ipage, Las Animas, Marlake, and McCook soils. Craft soils are well drained and on bottom lands. The nearly level or very gently sloping Ipage soils are on stream terraces or high bottom lands. The nearly level Las Animas soils are on bottom lands. The very poorly drained Marlake soils are in the lowest areas on the landscape. The nearly level McCook soils are well drained and on the higher parts of the association.

Most of the acreage in this association is in native grass and used for grazing or is mowed for native hay. The ranchers mainly have a beef cow-calf operation. Some areas are cultivated, and the irrigated crops are sugar beets, field beans, and alfalfa. Some livestock is fattened for market.

Alkalinity is the main limitation of the soils in this association. Production of grass and crops is limited by the strong and very strong alkalinity. The hazard of flooding and the high water table are limitations to farming in most areas. Soil alkalinity and wetness are the main management concerns in cultivated areas. Soil blowing is a hazard on unprotected surfaces. Regulating the timing and intensity of grazing and improving the range condition are the concerns of management on rangeland.

Farms and ranches in this association average about 800 acres. Many of the owners or operators reside on land outside this association. Wells provide sufficient water for livestock and domestic use. The cash-grain crops are marketed at local elevators. Sugar beets are delivered to weighing stations. Cattle are the main livestock, and most of these are marketed outside the county at local sale barns or at larger terminal markets. Some yearlings are sold direct to feeder buyers. Roads surfaced with crushed rock or improved dirt roads are on a few section lines. Trails provide access to most areas.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alliance loam, 1 to 3 percent slopes, is one of several phases in the Alliance series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Rosebud-Canyon complex, 3 to 9 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

Ac—Alliance loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on loess-covered uplands. Areas range from 5 to about 600 acres.

Typically, the surface layer is dark grayish brown, friable loam about 9 inches thick. The subsoil is about 14 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is light gray, friable, calcareous silt loam. The underlying material is very pale brown, calcareous very fine sandy loam. At a depth of about 43 inches is white, weakly cemented, limy sandstone. In some places the subsoil is loam. In a few areas the surface layer is very fine sandy loam, and in a few other areas it is less than 6 inches thick because of land leveling. Also, in some areas the dark material making up the surface layer and the upper part of the subsoil is more than 20 inches thick.

Included with this soil in mapping are small areas of Creighton, Hemingford, Rosebud, and Scott Variant soils. Creighton soils have more sand and less clay in the subsoil than the Alliance soil. Hemingford soils have more sand in the subsoil and the upper part of the underlying material. Rosebud soils are 20 to 40 inches deep to limy sandstone. Scott Variant soils are very poorly drained, have more clay in the subsoil, and are in depressions on uplands and stream terraces. The included soils make up about 5 to 15 percent of the unit.

This Alliance soil has moderate permeability and either moderate or high available water capacity, depending on the depth to bedrock. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. The

surface layer is easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is farmed. About one-half of the acreage is used for dryland farming, and the remaining areas are mainly irrigated cropland. A few areas are in native grass and are used for rangeland.

If used for dryland farming, this soil is suited to introduced grasses and alfalfa for hay and pasture and to winter wheat. Lack of summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is the principal hazard where the soil surface is not protected. Conservation tillage practices, such as stubble mulching, leave all or most of the crop residue on the surface and thereby help conserve needed soil moisture and help prevent soil blowing. The crop residue helps maintain the organic matter content and tilth. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. It is suited to both gravity and sprinkler irrigation systems. Soil blowing is the main hazard on unprotected fields. A cropping system that leaves crop residue on the surface helps control soil blowing. Mixing crop residue and barnyard manure into the soil helps maintain the fertility and organic matter content and also increases the infiltration of water. Some land leveling is generally needed for the satisfactory operation of gravity systems. All irrigation systems need to be designed so the rate of application of water does not exceed the moderately low intake rate of the soil.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species show fair growth and good survival. Drought and soil blowing are the principal hazards to seedlings and young trees. Seedlings can survive and grow if competing vegetation is controlled or removed by cultivation between the tree rows or by the careful use of appropriate herbicides. Planting an annual cover crop between the rows reduces soil blowing. Supplemental irrigation can provide needed moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by depth to rock. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of this soil if the bottom of the lagoon is sealed to prevent seepage. This soil is generally suited to use as a site for dwellings and small commercial buildings. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, and to the Silty range site and windbreak suitability group 3.

AcB—Alliance loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on loess-covered uplands. It is on slightly convex ridgetops and along some upland drainageways. Areas range from 5 to about 500 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is pale brown, friable silt loam. The underlying material is light gray and pale brown, calcareous very fine sandy loam and loam. At a depth of about 46 inches is white, weakly cemented, limy sandstone. In a few places the surface layer is very fine sandy loam, and in places the subsoil is loam. In some small areas the underlying material is sandy clay loam. In places the surface layer is less than 6 inches thick, mainly because of erosion. Also, in places the dark material making up the surface layer and the upper part of the subsoil is more than 20 inches thick.

Included with this soil in mapping are small areas of Canyon, Creighton, and Rosebud soils. Canyon soils are 8 to 20 inches deep to limy sandstone and are slightly higher on the landscape than the Alliance soil. Creighton soils have less silt and clay in the subsoil and generally are in the slightly higher areas on the landscape. Rosebud soils are 20 to 40 inches deep to limy sandstone and are on about the same position on the landscape. The included soils make up about 8 to 15 percent of the unit.

This Alliance soil has moderate permeability and either moderate or high available water capacity, depending on the depth to bedrock. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. The surface layer is friable and easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is cultivated. A few areas are in native grass. Over one-half of the cultivated acreage is used for dryland farming, and the remaining acreage is irrigated.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is the principal hazard on unprotected soil surfaces. Conservation tillage practices, such as stubble mulching and eco-fallow, can be used to help conserve needed soil moisture, to control soil blowing, and to

control water erosion following heavy rains. The crop residue helps maintain the organic matter content and tilth. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to sugar beets, field beans, corn, potatoes, alfalfa, and introduced grasses. This soil is suited to both gravity and sprinkler irrigation systems. A cropping system that leaves crop residue on the surface helps control soil blowing and water erosion, which are the main hazards. Returning crop residue to the soil helps maintain the organic matter content and also increases the infiltration of water. Some land leveling is needed for satisfactory operation of a gravity system. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderately low intake rate of the soil.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Drought and soil blowing are the main hazards to seedlings and young trees. Adapted species show fair growth and good survival. Competing vegetation can be controlled or removed by cultivation between the tree rows and by the careful use of appropriate herbicides. Planting an annual cover crop between the rows reduces damage from soil blowing. Supplemental irrigation can provide needed moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by depth to rock. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of this soil if, after excavation, the bottom of the lagoon is sealed to prevent seepage. This soil is generally suited to use as a site for dwellings. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, and to the Silty range site and windbreak suitability group 3.

AcC—Alliance loam, 3 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on convex ridgetops and knolls, and also on side slopes along drainageways that traverse the loess-covered uplands. Areas range from 5 to 100 acres.

Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part is brown, friable silty clay loam; the middle part is pale brown, friable silty clay loam; and the lower part is pale brown, very friable very fine sandy loam. The underlying material is light gray, calcareous loam. At a depth of about 40 inches is white, weakly cemented, limy sandstone. In some places the surface layer is lighter in color and thinner because of erosion. Also, in a few areas the surface layer is very fine sandy loam, and in a few places the dark material making up the surface layer is more than 20 inches thick. Also, in places the subsoil is loam and is less than 10 inches thick.

Included with this soil in mapping are small areas of Creighton, Rosebud, and Canyon soils. Creighton soils are coarser in texture in the upper and middle part of the subsoil. Rosebud soils are 20 to 40 inches deep to limy sandstone. Canyon soils are 8 to 20 inches deep to limy sandstone. These soils occupy about the same elevation. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Alliance soil is moderate. The available water capacity is either moderate or high, depending on the depth to bedrock. Runoff is medium. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is good, and the soil is easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is farmed. Most areas are used for dryland farming, but some are irrigated, mainly by the center-pivot type of sprinkler system. The remaining areas are mainly in native grass and used as hayland or rangeland.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Water erosion and soil blowing are the principal hazards. The soil needs to be adequately protected by growing crops or by crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, help conserve moisture and prevent serious erosion. Wind stripcropping, summer fallow, and cover crops can also be used. Terraces and contour farming are also effective in controlling erosion and conserving moisture. The crop residue helps maintain the organic matter content and tilth.

If irrigated, this soil is suited to corn, sugar beets, potatoes, introduced grasses, and alfalfa. This soil is best suited to the sprinkler type of irrigation system because of slope. It is suited to a gravity system if the land is bench leveled or if contouring is used in combination with terracing and conservation tillage. Erosion can be reduced by use of terraces, contour farming, and a conservation tillage system, such as no-till, which leaves most of the crop residue on the surface as a protective cover. The rate of application of water should be regulated so it does not exceed the moderately low intake rate of the soil. Returning crop

residue to the soil helps maintain the organic matter content and tilth and increases the infiltration of water. If the center-pivot type of sprinkler system is used, wheel track ruts are a problem.

This soil is suited to rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Seedlings generally survive and grow well if competing vegetation is controlled or removed. This can be accomplished by good site preparation and by timely cultivation or careful application of appropriate herbicides in the row. Drought is the main hazard in establishing trees, and supplemental watering of seedlings may be needed. Trees can be planted on the contour to help prevent erosion. Terraces may also be needed.

The use of this soil for septic tank absorption fields is limited by depth to rock. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of this soil if the bottom of the lagoon is sealed to prevent seepage. Also, some grading is required to modify the slope and shape the lagoon. This soil is generally suited to use as a site for dwellings. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated, and to the Silty range site and windbreak suitability group 3.

ArB—Alliance-Rosebud loams, 1 to 3 percent slopes. This unit consists of deep and moderately deep, very gently sloping, well drained soils. These soils are on the broad, convex ridgetops and on side slopes of intermittent drainageways that traverse the uplands. Areas of this complex range from 5 to about 500 acres. This unit ranges from 45 to 60 percent Alliance soil and from 30 to 50 percent Rosebud soil. The deep Alliance soil is on broad ridgetops. The moderately deep Rosebud soil is on narrow ridges or knolls and on side slopes. The areas of the Alliance soil and the areas of the Rosebud soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Alliance soil has a surface layer of dark grayish brown, friable loam about 8 inches thick. The subsoil is about 18 inches thick. It is grayish brown, friable silt loam in the upper part; brown, friable silty clay loam in the middle part; and light gray, friable, calcareous silt loam in the lower part. The underlying material is light gray. It is calcareous loam in the upper part and calcareous very fine sandy loam in the lower part. At a depth of about 42 inches is white, weakly cemented, limy sandstone. In some places the surface layer is very fine sandy loam. Also, in some places the subsoil is loam or sandy clay loam. In a few places the surface layer is eroded and is less than 4 inches thick, and in other places it is more than 20 inches thick. In places the underlying material is sandy clay loam or fine sandy loam.

Typically, the Rosebud soil has a surface layer of grayish brown, friable loam about 8 inches thick. The subsoil is about 16 inches thick. It is pale brown, friable clay loam in the upper part and light gray, friable, calcareous loam in the lower part. The underlying material is very pale brown, calcareous very fine sandy loam that has many small sandstone fragments. At a depth of 32 inches is white, weakly cemented, limy sandstone. In places the surface layer is very fine sandy loam. In a few places the original surface layer has been eroded, and the subsoil is exposed at the surface. Also, in some areas the subsoil is very fine sandy loam and less than 10 inches thick. In places the dark material making up the surface layer is more than 20 inches thick.

Included with these soils in mapping are small areas of Canyon soils. Canyon soils have a lighter colored surface layer, they are 8 to 20 inches deep to bedrock, and they are on the higher positions on the landscape. The included soils make up 10 to 15 percent of this unit.

Permeability of the Alliance and Rosebud soils is moderate. The available water capacity is either moderate or high in the Alliance soil, depending on the depth to bedrock, and is moderate in the Rosebud soil. Runoff is slow. The water intake rate for irrigation is moderately low. In both soils the organic matter content is moderate, and natural fertility is high. These soils have good tilth and can generally be tilled throughout a fairly wide range in moisture content.

Most of the acreage of these soils is used for dryland farming. Some areas are irrigated, and a few remain in native grass.

If used for dryland farming, these soils are suited to wheat, alfalfa, and introduced grasses. Inadequate summer rainfall limits the selection of cultivated crops that can be successfully grown. The main hazards are soil blowing and water erosion where the surface is not adequately protected by growing crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and water erosion and also conserve soil moisture. Wind stripcropping and summer fallow are also suited to this soil. Returning crop residue to the soil helps maintain the organic matter content, fertility, and tilth and also increases the infiltration of water.

If irrigated, these soils are suited to corn, field beans, potatoes, sugar beets, alfalfa, small grains, and introduced grasses. The main hazards are soil blowing and water erosion. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and can be used to reduce erosion and to conserve moisture. Returning crop residue to the soil helps maintain the organic matter content and also increases the infiltration of water. These soils are suited to both gravity and sprinkler irrigation systems. In designing a gravity system, care must be taken to ensure that the underlying bedrock is not exposed if the land is leveled. Irrigation systems need to be designed so that the rate of water application does not exceed the moderately low intake rate of the soils. Efficient management of irrigation water is important. Plowing under green manure crops is a good way to increase fertility and the infiltration of water in areas that have been disturbed by land leveling. Applications of phosphate and zinc increase fertility in the cut areas.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils are suitable for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought and competition for moisture from weeds and grasses are the principal hazards. Irrigation can provide moisture during periods of insufficient rainfall. Cultivation between the tree rows with conventional equipment can control undesirable weeds and grasses. Careful use of appropriate herbicides or hoeing by hand can control weeds within the tree row.

The use of these soils for septic tank absorption fields is limited by depth to rock. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of these soils if, after excavation, the bottom of the lagoon is sealed to prevent seepage. These soils are generally suited to use as sites for dwellings with basements, but an excavation in areas of the Rosebud soil generally extends into the soft bedrock. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed drainage.

These soils are assigned to capability units IIe-1, dryland, and IIe-4, irrigated, and to the Silty range site. The Alliance soil is in windbreak suitability group 3, and the Rosebud soil is in windbreak suitability group 6R.

ArC—Alliance-Rosebud loams, 3 to 6 percent slopes. This unit consists of deep and moderately deep, gently sloping, well drained soils. These soils are on ridgetops and on side slopes of drainageways in the uplands. Areas of this complex range from 5 to 200 acres. This unit ranges from 40 to 55 percent Alliance soil and from 30 to 50 percent Rosebud soil. The deep Alliance soil is on the broad ridgetops and the lower part of the side slopes. The moderately deep Rosebud soil is on narrow ridgetops and the upper part of side slopes. The areas of the Alliance soil and the areas of the Rosebud soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Alliance soil has a surface layer of dark grayish brown, friable loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, friable silty clay loam, and the lower part is light brownish gray, friable silt loam. The underlying material is light gray, calcareous very fine sandy loam. At a depth of about 43 inches is white, weakly cemented, limy sandstone. In places the subsoil is loam or sandy clay loam. In a few places the surface layer is very fine sandy loam, and in a few other areas the surface layer is eroded and is less than 8 inches thick. In places the underlying material is fine sandy loam or sandy clay loam.

Typically, the Rosebud soil has a surface layer of dark grayish brown, friable loam about 8 inches thick. The subsoil is about 10 inches thick. The upper part is grayish brown, friable clay loam, and the lower part is light brownish gray, friable, calcareous loam. The underlying material is light gray, calcareous loam. At a depth of about 24 inches is white, weakly cemented, limy sandstone. In a few places the surface layer is very fine sandy loam. In other places the erosion of the surface layer has exposed the upper part of the subsoil. In some areas the subsoil and underlying material are very fine sandy loam.

Included with these soils in mapping are small areas of Canyon soils. Canyon soils are 8 to 20 inches deep to bedrock and are on short breaks and the upper part of side slopes. The included soils make up about 10 to 15 percent of this unit.

Permeability of the Alliance and Rosebud soils is moderate. The available water capacity is either moderate or high in the Alliance soil, depending on the depth to bedrock. It is moderate in the Rosebud soil. Runoff is medium. The water intake rate for irrigation is moderately low. Both soils are moderate in organic matter content and high in natural fertility. These soils have good tilth and can be easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of these soils is used for dryland farming. Some areas are irrigated, and a few small areas are still in native grass.

If used for dryland farming, these soils are suited to wheat, alfalfa, and introduced grasses. Soil blowing and water erosion are hazards where the surface is not adequately protected by growing crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, which keep crop residue on the surface, help prevent soil blowing and water erosion and also conserve moisture. The crop residue helps maintain the organic matter content, fertility, and tilth and also increases the infiltration of water. These soils are suited to construction of terraces for erosion control; however, construction may be difficult in areas of the Rosebud soil because of the limited amount of soil material over the weakly cemented bedrock. Wind stripcropping and summer fallow are practices that can be used to help control soil blowing and conserve moisture.

If irrigated, these soils are suited to corn, sugar beets, small grains, potatoes, introduced grasses, and alfalfa. A sprinkler system is better suited to these soils than a gravity system. Bench leveling is difficult because of the moderate depth to sandstone bedrock in areas of the Rosebud soil. The gravity system of irrigation is suitable if contouring is used in combination with terracing and conservation tillage. Soil blowing and water erosion are the main hazards if the soil is cultivated. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and thereby help to prevent soil blowing and water erosion. Returning crop residue to the soil helps maintain the organic matter content and increases the infiltration of water. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderately low intake rate of the soils. If the center-pivot type of sprinkler system is used, erosion in the wheel tracks is a problem.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils are suited to trees and shrubs in windbreaks. Adapted species generally show fair growth and survival if competing vegetation is controlled or removed. This can be accomplished by good site preparation and by timely cultivation or careful application of appropriate herbicides. Hoeing by hand or rototilling can control undesirable vegetation in the rows or near small trees. Drought is the principal hazard to the establishment of trees, and supplemental watering of the seedlings may be needed. Trees can be planted on the contour to help prevent water erosion.

The use of these soils for septic tank absorption fields is limited by depth to rock. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of these soils if the bottom of the lagoon is sealed to prevent seepage. Some grading is also required to modify the slope and shape the lagoon. These soils are generally suited to use as sites for dwellings without basements. Dwellings with basements are generally suitable in areas of the Alliance soil, but in areas of the Rosebud soil an excavation generally extends into the weakly cemented bedrock. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

These soils are assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated, and to the Silty range site. The Alliance soil is in windbreak suitability group 3, and the Rosebud soil is in windbreak suitability group 6R.

ArD—Alliance-Rosebud loams, 6 to 11 percent slopes. This unit consists of deep and moderately deep, strongly sloping, well drained soils. These soils are on ridgetops and side slopes of drainageways in the uplands. Areas of this complex range from 5 to 60 acres. This unit ranges from 35 to 50 percent Alliance soil and from 30 to 50 percent Rosebud soil. The deep Alliance soil is on the broad ridgetops and the lower part of the side slopes. The moderately deep Rosebud soil is on narrow ridgetops and the upper part of the side slopes. The areas of the Alliance soil and the areas of the Rosebud soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Alliance soil has a surface layer of dark grayish brown, very friable loam about 9 inches thick. The subsoil is about 10 inches thick. It is light brownish gray, friable silt loam in the upper part and pale brown, very friable, calcareous very fine sandy loam in the lower part. The underlying material is light gray and pale brown, calcareous very fine sandy loam. At a depth of about 58 inches is white, weakly cemented, limy sandstone. In places the surface layer is very fine sandy loam. In some places the upper part of the subsoil is very fine sandy loam or loam. In some areas the surface layer is eroded and is less than 4 inches thick.

Typically, the Rosebud soil has a surface layer of dark grayish brown, friable loam about 8 inches thick. The subsoil is about 14 inches thick and friable. The upper part is grayish brown clay loam, and the lower part is pale brown loam. The underlying material is very pale brown, calcareous very fine sandy loam. Below a depth of about 29 inches is white, weakly cemented, limy sandstone. In some areas where water erosion has been severe, most of the original surface layer has been removed and the subsoil is exposed. In a few places the surface layer is very fine sandy loam. Also, in a few areas the subsoil is very fine sandy loam.

Included with these soils in mapping are small areas of Canyon and Craft soils. Canyon soils are shallow to bedrock and are on the higher part of the landscape. Craft soils are stratified and are on narrow bottom lands along drainageways. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Alliance and Rosebud soils is moderate. The available water capacity is either moderate or high in the Alliance soil, depending on the depth to bedrock, and it is moderate in the Rosebud soil. Runoff is medium. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is good, and the soils are easily tilled throughout a fairly wide range in moisture content.

More than one-half of the acreage of these soils is used for dryland farming. A few areas are irrigated. The remaining acreage is in native grass and is used for hayland or grazing.

If used for dryland farming, these soils are poorly suited to wheat, alfalfa, introduced grasses, and legumes. Soil blowing and water erosion are the principal hazards. The surface needs to be adequately protected by growing crops or by crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, keep crop residue on the surface and thereby help conserve moisture and control soil blowing and water erosion. Conserving moisture is important in areas of the Rosebud soil because the available water capacity is moderate. Construction of terraces is difficult on this unit because of the limited amount of soil over bedrock in areas of the Rosebud soil. Wind stripcropping helps control soil blowing. Summer fallow stores moisture for use during the following growing season.

If irrigated, these soils are not suited to row crops and are poorly suited to alfalfa, small grains, and introduced grasses. Water erosion is a serious hazard. Efficient management of irrigation water is necessary because of slope and the moderately low intake rate of the soils. Applying water at a rate that exceeds the intake rate of the soil can result in severe erosion on these slopes. Infiltration of water can be increased by keeping most of the crop residue on the soil surface. This also helps to maintain the organic matter content and tilth. Sprinkler irrigation systems can be used, but gravity systems are not suitable on these soils. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and thereby help to prevent water erosion and allow moisture to enter the soil more readily.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed in some eroded areas of cropland to help stabilize the soil.

These soils are suited to trees and shrubs in windbreaks. Adapted species show fair growth and survival. Seedlings generally survive and grow if competing vegetation is controlled or removed. This can be accomplished by good site preparation and by timely cultivation or careful application of appropriate herbicides. Rototilling or hand hoeing can be used to control undesirable vegetation in the row. Drought is the main hazard when planting trees, and supplemental watering of the seedlings may be needed. Planting trees on the contour helps control water erosion. Annual cover crops can be used between the rows.

The use of these soils for septic tank absorption fields is limited by depth to rock and moderate permeability. These limitations can generally be overcome by increasing the size of the absorption field. Also, installing the septic tank absorption field on the contour is generally necessary for its proper operation. If sewage lagoons are constructed, extensive grading is required to modify the slope and shape the lagoon. The bottom of the lagoon needs to be sealed to prevent seepage. Dwellings should be properly designed to complement the slope, or the soil should be graded. Excavation of the weakly cemented bedrock in areas of the Rosebud soil may be necessary if this soil is used as a site for dwellings with basements. Damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. Cuts and fills are generally needed to provide a suitable grade.

These soils are assigned to capability units IVe-1, dryland, and IVe-4, irrigated, and to the Silty range site. The Alliance soil is in windbreak suitability group 3, and the Rosebud soil is in windbreak suitability group 6R.

Ba—Bankard fine sand, 0 to 2 percent slopes. This deep, somewhat excessively drained, nearly level soil is on bottom lands. This soil is occasionally flooded. Areas are generally long and narrow and range from 10 to 100 acres.

Typically, the surface layer is light brownish gray, loose, calcareous fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light gray, calcareous gravelly sand and sand. In some areas the surface layer is loamy fine sand or very fine sandy loam. Also, in a few places the upper part of the underlying material is loamy fine sand or loamy very fine sand. In some places free carbonates are at a depth of 6 to 18 inches.

Included with this soil in mapping are small areas of Valent soils. Valent soils do not have stratification and gravelly fragments in the control section and are on a

slightly higher part of the landscape than the Bankard soil. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Bankard soil is rapid, and the available water capacity is low. Runoff is slow. The organic matter content and natural fertility are low.

Nearly all of the acreage of this soil is in native grass. A few small areas are farmed because they are in fields dominated by soils suited to farming.

This soil is not suited to farming, either dryland or irrigated, because of the flooding hazard and coarse texture of the soil.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil generally provides a poor site for trees and shrubs in windbreaks or for plantings in recreation and wildlife areas. Capability for survival and growth of adapted species is poor. The low available water capacity and the hazard of flooding make successful planting on this soil difficult.

This soil is not suited to use as septic tank absorption fields or as a site for buildings because of flooding. A suitable alternate site is needed. Sewage lagoons need to be lined or sealed to prevent seepage, and they need dikes for protection from flooding. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help to protect roads from flood damage.

This soil is assigned to capability unit VIe-5, dryland, and to the Shallow to Gravel range site and windbreak suitability group 10.

BbB—Bankard very fine sandy loam, 0 to 3 percent slopes. This deep, somewhat excessively drained, nearly level and very gently sloping soil is on bottom lands. This soil is occasionally flooded. Areas are generally long and narrow and range from 5 to about 50 acres.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 4 inches thick. The upper part of the underlying material is pale brown, calcareous loamy fine sand, and below this, to a depth of 60 inches or more, is light gray, calcareous fine sand. In places the surface layer is loamy fine sand or loamy very fine sand. Also, in places the upper part of the underlying material is loamy very fine sand. In some areas the surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Craft and Valent soils. Craft soils are well drained and have less sand in the underlying material than the Bankard soil. Valent soils are not stratified, they formed in eolian sediment, and they are on the higher part of the landscape. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Bankard soil is rapid, and the available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content and natural fertility are low. Tilth is good throughout a wide range in moisture content.

Nearly all the acreage of this soil is in native grass and is used for grazing. A few areas are in irrigated crops.

If used for dryland farming, this soil is poorly suited to crops commonly grown in this area, including alfalfa, winter wheat, and introduced grasses. This soil is droughty because the available water capacity is low. The main hazards are soil blowing and flooding. Conservation tillage practices, such as stubble mulching, leave all or part of the crop residue on the surface and thereby help control soil blowing. Wind stripcropping also helps prevent soil blowing. The crop residue helps improve the fertility and the organic matter content. Diversions and dikes can reduce flooding. Summer fallow stores moisture for use during the following growing season.

If irrigated, this soil is suited to corn, small grains, alfalfa, and introduced grasses. Soil blowing is a serious hazard if the soil surface is not protected. Flooding can be controlled by protecting the field with diversions or dikes. A conservation tillage system, such as stubble mulching, leaves crop residue on the surface and thereby helps control soil blowing. Mixing crop residue and green manure crops into the soil helps improve the organic matter content and fertility. This soil is droughty, and the irrigation water needs to be applied frequently. Supplemental applications of nitrogen and phosphorus are needed to overcome plant nutrient deficiencies. Nutrients are lost by leaching if excessive amounts of water are applied. This soil is best suited to sprinkler systems because it has a very high intake rate for water, has a low available water capacity, and needs frequent applications of water.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in succesive years.

This soil provides a good site for trees and shrubs in windbreaks. The growth and survival rates of adapted species are fair. Drought and soil blowing are the main hazards to seedlings. Tillage or chemical methods are effective in preparing a favorable site for plantings. Soil blowing can be controlled by maintaining strips of cover

between the tree rows. Supplemental water can provide needed moisture during periods of insufficient rainfall. Dikes can be used to prevent flooding. Undesirable weeds and grasses can be controlled by cultivating or mowing between the rows. Annual cover crops can also be used to control undesirable vegetation. Appropriate herbicides can be applied in the row or the areas can be hoed by hand or rototilled.

This soil is not suited to septic tank absorption fields, sewage lagoons, or building sites because of flooding. Suitable alternate sites are needed. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help protect roads from flood damage.

This soil is assigned to capability units IVe-3, dryland, and IVe-11, irrigated, and to the Sandy Lowland range site and windbreak suitability group 5.

Br—Bridget very fine sandy loam, 0 to 1 percent slopes. This soil is deep, nearly level, and well drained. It is mainly on foot slopes and stream terraces, but in places it is along the bottom of upland drainageways and in upland basins. This soil is subject to rare flooding. Areas range from 5 to 300 acres.

Typically, the surface layer is grayish brown, friable, and 17 inches thick. The upper part is very fine sandy loam, and the lower part is loam. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous loam in the upper part; light brownish gray, calcareous very fine sandy loam in the middle part; and light gray, calcareous very fine sandy loam in the lower part. In some places the surface layer is fine sandy loam or loam. In some areas the dark material making up the surface layer is more than 20 inches thick.

Included with this soil in mapping are small areas of Craft soils. Craft soils are stratified and generally are on a lower part of the landscape than the Bridget soil. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Bridget soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. This soil is easily tilled throughout a wide range in moisture content.

Over one-half of the acreage of this soil is farmed, and the rest is mainly in native grass. Most of the cultivated areas are used for dryland farming; some are irrigated.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and legumes. Lack of summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is a hazard where the surface is not adequately protected by crops or crop residue. Conservation tillage practices, such as no-till and stubble mulching, leave all or part of the crop residue on the surface and thereby help prevent soil blowing and conserve soil moisture. Mixing crop residue into the soil helps maintain the organic matter content and tilth. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, introduced grasses, and alfalfa. This soil is suited to both sprinkler and gravity types of irrigation systems. Soil blowing is the most serious hazard. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and thereby reduce soil blowing. Efficient management of irrigation water is also a concern. Some land leveling is generally needed for the satisfactory operation of a gravity system. Irrigation systems need to be designed so the rate of application of water does not exceed the moderate intake rate of this soil. Applying feedlot manure and other kinds of organic residue is a good way to increase the infiltration of water and improve the organic matter content, especially in areas that have been disturbed during land leveling operations.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, untimely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. The survival and growth rates of adapted species are good. Careful use of appropriate herbicides in the tree row or cultivation with conventional equipment can be used to help control weeds and grasses. Hoeing by hand or rototilling can control the weeds and grasses in the rows or near small trees. Supplemental watering can provide needed moisture during periods of insufficient rainfall.

The hazard of rare flooding needs to be considered if this soil is used as a site for sanitary facilities and as a site for buildings. Dikes can protect septic tank absorption fields and sewage lagoons from the floodwaters. The use of this soil for septic tank absorption fields is limited by moderate permeability, but this limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. Dwellings and buildings can be constructed if the site is elevated with well compacted fill material as protection against flooding. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help protect roads from flood damage. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate

side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-6, irrigated, and to the Silty range site and windbreak suitability group 3.

BrB—Bridget very fine sandy loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and well drained. It is on foot slopes, stream terraces, and in a few places, along the bottom of upland drainageways. Areas range from 5 to 300 acres.

Typically, the surface layer is grayish brown, friable very fine sandy loam about 10 inches thick. The subsurface layer is dark grayish brown loam about 4 inches thick. The next layer is light brownish gray, friable, calcareous loam about 5 inches thick. The underlying material to a depth of 60 inches or more is calcareous. It is light gray loam in the upper part; light brownish gray very fine sandy loam in the middle part; and light gray very fine sandy loam in the lower part. In places the dark material making up the surface layer is more than 20 inches thick. In some areas the surface layer is fine sandy loam or loam. In a few places free carbonates are at a depth of more than 15 inches.

Included with this soil in mapping are small areas of Busher, Craft, and Rosebud soils. Busher soils have more sand and less clay in the control section and are higher on the landscape than the Bridget soil. Craft soils are stratified and are on bottom lands. Rosebud soils are 20 to 40 inches deep to bedrock and are slightly higher on the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Bridget soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. This soil is easily tilled throughout a wide range in moisture content.

More than one-half of the acreage of this soil is cultivated. The rest is in native grass. Most cultivated areas are used for dryland farming; some are irrigated.

If used for dryland farming, this soil is suited to wheat, introduced grasses, and legumes. Lack of summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is a hazard where the surface is not adequately protected by crops or crop residue. Conservation tillage methods, such as no-till planting, stubble mulching, and eco-fallow, leave crop residue on the surface and thereby help to prevent soil blowing and help to conserve soil moisture. The crop residue helps maintain the organic matter content, fertility, and tilth of the soil and also increases the infiltration of water into the soil. Wind stripcropping and summer fallow are good practices to use on this soil.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, introduced grasses, and alfalfa. This soil is suited to both gravity and sprinkler irrigation systems. Soil blowing is the most serious hazard. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and reduce soil blowing. Efficient management of irrigation water is also a concern. This soil is suited to a gravity system where the soil has been leveled and a suitable grade has been established to prevent water erosion. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderate intake rate of this soil. Applying feedlot manure and crop residue increases the infiltration of water and improves the organic matter content in areas that have been disturbed by land leveling.

This soil is suited to rangeland, and this use is effective in controlling both soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species generally show good growth and survival if competing vegetation is controlled or removed. Weeds and grasses can be controlled by timely cultivation between the tree rows and by careful use of appropriate herbicides, hand hoeing, or rototilling in the rows. Supplemental watering can provide moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by moderate permeability. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. This soil is generally suited to use as a site for dwellings and small commercial buildings. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIe-1, dryland, and IIe-6, irrigated, and to the Silty range site and windbreak suitability group 3.

BrC—Bridget very fine sandy loam, 3 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on foot slopes and stream terraces, and in a few places along the bottom of upland drainageways. Areas range from 5 to about 50 acres.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 7 inches thick. The next layer is brown, very friable, calcareous very fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches or more is

light brownish gray, calcareous very fine sandy loam. In some places the surface layer is fine sandy loam or loam. In a few areas the underlying material is loam. In places, free carbonates are below a depth of 15 inches and the dark material making up the surface layer is more than 20 inches thick.

Included with this soil in mapping are small areas of the moderately sandy Busher soils. They generally are on the upper part of foot slopes. These inclusions make up about 5 percent of the unit.

Permeability of this Bridget soil is moderate, and the available water capacity is high. Runoff is medium. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. This soil is easily tilled throughout a wide range in moisture content.

Most of the acreage of this soil is in native grass, and the rest is farmed. Most of the cultivated areas are used for dryland farming.

If used for dryland farming, this soil is suited to winter wheat, as well as to introduced grasses and legumes for pasture and hay. Lack of summer rainfall limits the selection of cultivated crops that can be grown. Water erosion is the principal hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and erosion by water and also help to conserve soil moisture. Use of crop residue helps maintain the organic matter content, fertility, and soil tilth and also increases the infiltration of water. Terraces, stripcropping, and summer fallow are suitable practices on this soil.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, introduced grasses, and alfalfa. Soil blowing and water erosion are the principal hazards. Conservation tillage practices, which keep crop residue on the surface, or farming practices that roughen the unprotected soil surface can reduce erosion. Efficient management of irrigation water is also a concern. Sprinkler systems need to be designed so that the rate at which water is applied does not exceed the moderate intake rate of this soil. This soil is suited to a gravity system if it is bench leveled or if contouring is used in combination with terracing and conservation tillage.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the natural vegetation. Overgrazing can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. The survival and growth rates of adapted species are good. Control of weeds and undesirable grasses can be accomplished by timely cultivation between the tree rows. Careful use of appropriate herbicides or rototilling in the rows can also be used. A combination of contour planting and terracing can help prevent water erosion. Supplemental watering can provide needed moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by moderate permeability. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. Also, some grading is required to modify the slope and shape the lagoon. This soil is generally suited to use as a site for dwellings. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-6, irrigated, and to the Silty range site and windbreak suitability group 3.

BuB—Busher-Jayem loamy very fine sands, 0 to 3 percent slopes. This map unit consists of deep, nearly level and very gently sloping, well drained soils. These soils are on low knolls and hummocks of the uplands. Areas of this complex range from 5 to about 200 acres. This unit consists of 45 to 60 percent Busher soil and from 20 to 30 percent Jayem soil. The Busher soil is in flat or slightly concave areas, and the Jayem soil is in slightly convex areas. The areas of the Busher soil and the areas of the Jayem soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Busher soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 12 inches thick. The subsoil is brown, very friable loamy very fine sand about 13 inches thick. The underlying material, to a depth of 58 inches, is pale brown loamy very fine sand in the upper part and light brownish gray fine sandy loam in the lower part. Below this is weakly cemented, limy sandstone. In some places the soil material is fine sandy loam or very fine sandy loam above the bedrock. Also, in some areas the dark material making up the surface layer is more than 20 inches thick, and in a few places it is less than 5 inches thick. In places sandstone bedrock is below a depth of 60 inches.

Typically, the Jayem soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 8 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 13 inches thick. The underlying material to a depth of 60 inches or more is brown loamy very fine sand in the upper part and brown loamy fine sand in the lower part. In some areas the surface layer and underlying material are fine sandy loam or very fine sandy loam. Also, in some places the dark material making up the surface layer is more than 20 inches thick. In a few areas the surface layer is loamy fine sand.

Included with this unit in mapping are small areas of Satanta and Tassel soils. Satanta soils have more clay in the subsoil and in the upper part of the underlying material than the Busher and Jayem soils. Tassel soils are no more than 10 to 20 inches deep to weakly cemented sandstone and are on slightly higher parts of the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Busher and Jayem soils is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is medium. These soils are easily tilled throughout a fairly wide range in moisture content.

About one-half of the acreage of these soils is farmed, and the remaining areas are mainly in native grass. Most cultivated areas are used for dryland farming; some are irrigated.

If used for dryland farming, these soils are suited to winter wheat, alfalfa, and introduced grasses for hay and pasture. Inadequate summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is a serious hazard where the surface is not adequately protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, help conserve soil moisture and help control soil blowing. Wind stripcropping and the use of cover crops also help control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, these soils are suited to sugar beets, field beans, corn, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard and is especially severe on unprotected soil surfaces. Conservation tillage practices, such as no-till and till-plant, keep crop residue on the surface and help control soil blowing. These soils are well suited to sprinkler irrigation systems because of their moderately high intake rate. These soils are also suited to gravity systems if the proper grade is established so that the movement of water and the intake rate of the soil are uniform. Leaching causes loss of nutrients in the soil if irrigation is excessive.

The use of these soils for rangeland is an effective way to control soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe soil loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils provide a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Seedlings generally survive and grow if the site is properly prepared and competing vegetation is controlled. Soil blowing is a serious hazard. It can be controlled by maintaining strips of sod or cover crops between the tree rows. Cultivation of the competing vegetation should be restricted to the tree row. Drought is another hazard when planting trees. Supplemental watering can provide needed moisture during periods of insufficient rainfall.

The Jayem soil is generally suited to septic tank absorption fields. In areas of the Busher soil, increasing the size of the absorption field generally overcomes the limited depth to bedrock. Sewage lagoons need to be lined or sealed to prevent seepage. These soils are generally suited to use as sites for dwellings, small commercial buildings, and roads and streets.

These soils are assigned to capability units IIIe-3, dryland, and IIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

BuC—Busher-Jayem loamy very fine sands, 3 to 6 percent slopes. This map unit consists of deep, gently sloping, well drained soils. These soils are on ridgetops and short side slopes of the uplands. Areas of this complex range from 5 to about 400 acres. The unit consists of 45 to 60 percent Busher soil and 20 to 30 percent Jayem soil. The Busher soil is on side slopes and in slightly concave areas, and the Jayem soil is on low convex ridges. The areas of the Busher soil and the areas of the Jayem soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Busher soil has a surface layer of grayish brown, very friable loamy very fine sand about 11 inches thick. The subsoil is brown, very friable loamy very fine sand about 12 inches thick. The underlying material is calcareous loamy very fine sand. It is brown in the upper part and light gray in the lower part. At a depth of about 56 inches is white, weakly cemented, limy sandstone. In some places the soil is very fine sandy loam or fine sandy loam above the bedrock. Also, in some areas the dark material making up the surface layer is less than 5 inches thick. In a few places the surface layer is loamy fine sand.

Typically, the Jayem soil has a surface layer of grayish brown, very friable loamy very fine sand about 7 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is grayish brown loamy very fine sand in the upper part and pale brown, calcareous loamy fine sand in the lower part. In some places the soil is very fine sandy loam or fine sandy loam throughout the profile. Also, in a few areas the surface layer is loamy fine sand. In a few places the dark material making up the surface layer is more than 20 inches thick.

Included with these soils in mapping are small areas of Satanta, Tassel, and Valent soil. Satanta soils are finer in texture in the subsoil and upper part of the underlying

material than the Busher and Jayem soils. Tassel soils are 8 to 20 inches deep to weakly cemented sandstone and are in the slightly higher areas. Valent soils are coarser in texture, have a thinner surface layer, and are generally higher on the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Busher and Jayem soils is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is medium. These soils are easily tilled throughout a fairly wide range in moisture content.

About one-half of the acreage of these soils is farmed. Most of these areas are used for dryland farming; a few are sprinkler irrigated. The remaining areas are mainly in native grass.

If used for dryland farming, these soils are poorly suited to winter wheat, alfalfa, and introduced grasses. Lack of summer rainfall limits the selection of crops that can be grown. Soil blowing is a serious hazard where the surface is not adequately protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, help control soil blowing and to conserve soil moisture. Wind stripcropping, terracing, and the use of annual cover crops and summer fallow are additional practices.

If irrigated, these soils are suited to corn, field beans, sugar beets, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard. This soil is better suited to a sprinkler irrigation system than to a gravity system. Conservation tillage practices, such as eco-fallow and no-till, leave most or all of the crop residue on the surface and reduce soil blowing and improve the organic matter content. These soils are well suited to sprinkler irrigation systems because of their moderately high intake rate. The application of excessive amounts of water to the soil can cause leaching of nutrients.

These soils are suited to rangeland use, which is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils are suited to trees and shrubs in windbreaks. Adapted species show fair growth and survival if competing weeds and grasses are controlled. Cultivation of competing vegetation needs to be restricted to the tree row because of the hazard of soil blowing. Maintaining strips of sod or cover crops between the tree rows can help control soil blowing. Drought is also a hazard for seedlings. Supplemental watering can provide needed moisture during periods of insufficient rainfall.

The Jayem soil is generally suited to septic tank absorption fields. In areas of the Busher soil, increasing the size of the absorption field generally overcomes the limited depth to bedrock. Suitable fill material is needed to increase the filtering capacity of the soil. Sewage lagoons on these soils need to be lined or sealed to prevent seepage. These soils are generally suited to use as sites for dwellings and roads and streets.

These soils are assigned to capability units IVe-3, dryland, and IIIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

BuD—Busher-Jayem loamy very fine sands, 6 to 9 percent slopes. This map unit consists of deep, strongly sloping, well drained soils. The soils are on side slopes and ridgetops of the uplands. Areas of this complex range from 5 to about 200 acres. The unit ranges from 50 to 60 percent Busher soil and 20 to 30 percent Jayem soil. The Busher soil is on the upper part of side slopes and on most ridgetops, and the Jayem soil is on the lower part of side slopes and in slightly concave areas. The areas of the Busher soil and the areas of the Jayem soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Busher soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 9 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 11 inches thick. The underlying material, to a depth of 44 inches, is light brownish gray, calcareous loamy very fine sand with a few small fragments of sandstone. Below this is light gray, weakly cemented, limy sandstone. In some areas the soil is fine sandy loam or very fine sandy loam above the bedrock. Also, in places the dark material making up the surface layer is less than 4 inches thick. In a few areas the surface layer is loamy fine sand.

Typically, the Jayem soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 7 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown loamy very fine sand in the upper part and light brownish gray, calcareous loamy fine sand in the lower part. In some areas the soil is fine sandy loam or very fine sandy loam above the bedrock. Also, in some places the dark material making up the surface layer is more than 20 inches thick. In a few areas the surface layer is loamy fine sand.

Included with this unit in mapping are small areas of Satanta, Tassel, and Valent soils. Satanta soils have more clay in the subsoil and in the upper part of the underlying material than the Busher and Jayem soils. Tassel soils are 8 to 20 inches deep to sandstone bedrock and are on the higher positions on the

landscape. Valent soils are coarser in texture. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Busher and Jayem soils is moderately rapid, and the available water capacity is moderate. Runoff is medium. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is medium. These soils are easily tilled throughout a fairly wide range in moisture content.

Most of the acreage of these soils is in native grass. The remaining areas are cultivated, almost entirely under dryland farming.

If used for dryland farming, these soils are poorly suited to winter wheat, introduced grasses, and alfalfa. Insufficient summer rainfall commonly limits the selection of crops that can be successfully grown. Soil blowing is a serious hazard, and the surface needs to be adequately protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, leave crop residue on the surface and thereby help prevent soil blowing and water erosion. Wind stripcropping, terracing, and the use of annual cover crops and summer fallow are additional practices.

If irrigated, these soils are poorly suited to alfalfa and introduced grasses. These soils are suited only to the sprinkler type of irrigation system. Soil blowing is a severe hazard. A conservation cropping system, such as eco-fallow or no-till, leaves crop residue on the surface and thereby helps control soil blowing and water erosion. Returning crop residue to the soil and applying barnyard manure helps maintain and improve the organic matter content and fertility. Efficient management of irrigation water is important because of the moderately high water intake rate of these soils. The application of excessive amounts of irrigation water can cause leaching of nutrients.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Loss of plant cover can cause severe losses by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed in some areas of eroded cropland.

These soils are suited to trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought and soil blowing are the main hazards. Supplemental watering can provide needed moisture during periods of insufficient rainfall. Maintaining a strip of sod or a cover crop between the tree rows helps control soil blowing. Competing vegetation in the tree row and close to it can be controlled by rototilling, by hand hoeing, or by the use of appropriate herbicides.

Planting on the contour and terracing will help prevent water erosion.

Septic tank absorption fields need to be placed on the contour because of excessive slope. In areas of the Busher soil, increasing the size of the absorption field generally overcomes the limited depth to bedrock. If sewage lagoons are constructed, extensive grading is required to modify the slope and shape the lagoon. Lagoons also need to be lined or sealed to prevent seepage. Dwellings should be designed to complement the slope, or sites should be graded. Cuts and fills may be needed to provide a suitable grade for roads and streets.

These soils are assigned to capability units IVe-3, dryland, and IVe-8, irrigated, and to the Sandy range site and windbreak suitability group 7.

BvC—Busher-Tassel loamy very fine sands, 0 to 6 percent slopes. This map unit consists of deep and shallow, nearly level to gently sloping, well drained soils. These soils are on convex knolls and short side slopes of the uplands. Areas of the complex range from 5 to 250 acres. The unit ranges from 50 to 65 percent deep Busher soil and from 25 to 35 percent shallow Tassel soil. The Busher soil is on the broader ridgetops and the lower part of side slopes. The Tassel soil is on the upper part of side slopes and on narrow ridgetops. The areas of the Busher soil and the areas of the Tassel soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Busher soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 13 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 7 inches thick. The underlying material, to a depth of about 55 inches, is light brownish gray and light gray, calcareous fine sandy loam. Below this is white, weakly cemented, limy sandstone. In some areas the surface layer and subsoil are very fine sandy loam or fine sandy loam. Also, in places the dark material making up the surface layer is less than 5 inches thick. In a few areas the underlying material is loamy very fine sand.

Typically, the Tassel soil has a surface layer of grayish brown, very friable loamy very fine sand about 4 inches thick. The underlying material, to a depth of about 14 inches, is light brownish gray, calcareous loamy very fine sand. Below this is white, weakly cemented, limy sandstone. In some places the surface layer is fine sandy loam or very fine sandy loam. Rock fragments of sandstone are in all horizons above the bedrock.

Included with these soils in mapping are small areas of Valent soils and Rock outcrop. Valent soils are coarser in texture than Busher and Tassel soils and are more than 60 inches deep to sandstone. Rock outcrop is in the higher areas and on the short breaks. The inclusions make up about 5 to 15 percent of the unit.

Permeability of the Busher and Tassel soils is moderately rapid. The available water capacity is moderate in the Busher soil and very low in the Tassel soil. Runoff is slow on both soils. The water intake rate for irrigation is moderately high. The organic matter content is moderately low in the Busher soil and low in the Tassel soil. Natural fertility is medium in the Busher soil and low in the Tassel soil. These soils have good tilth, except in places where rock fragments are in areas of the Tassel soil.

Most of the acreage of these soils is in native grass and is used for range. The remaining areas are used for dryland farming.

If used for dryland farming, these soils are poorly suited to winter wheat, introduced grasses, and alfalfa. Lack of sufficient rainfall limits the selection of cultivated crops that can be successfully grown. The restricted rooting zone, low fertility, and very low available water capacity of the Tassel soil also limit production. Soil blowing is a serious hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, help control soil blowing and also conserve moisture. Wind stripcropping and planting annual cover crops are other suitable practices. Bedrock is near the surface in areas of Tassel soil and makes terracing difficult. Summer fallow conserves moisture for use during the following growing season.

If irrgated, these soils are poorly suited to alfalfa, corn, field beans, sugar beets, potatoes, and introduced grasses. A sprinkler system is the most suitable type of irrigation system for these soils. Soil blowing is the main hazard. A conservation tillage system, such as eco-fallow or no-till, leaves crop residue on the surface and helps control soil blowing and water erosion. These soils are somewhat droughty because of the limited root zone and the very low available water capacity of the Tassel soil, and timely application of water is needed. An excessive amount of irrigation water causes leaching of nutrients in areas of the Busher soil.

The use of the soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native grasses. It also can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

The Busher soil is suited to trees and shrubs in windbreaks, and adapted species generally show fair growth and survival. The Tassel soil is not suited to windbreak plantings because of the shallowness to bedrock. Onsite investigation is generally needed before planting time. The main hazards on the Busher soil are competition from weeds and grasses and soil blowing. Cultivating the tree row with a rototiller helps control undesirable weeds and grasses and makes it possible to leave strips of sod between the rows to help control soil blowing. Careful application of appropriate herbicides in the row also aids in weed control. Drought is also a hazard to young trees. Supplemental watering can provide needed moisture during periods of insufficient rainfall.

Onsite investigation is needed before building sites are planned on these soils. In areas of the Busher soil, increasing the size of septic tank absorption fields can generally overcome the limited depth to bedrock. The Tassel soil is generally not suitable because of the shallowness to bedrock. Areas of the Busher soil are suitable for sewage lagoons if the bottom of the lagoon is sealed or lined to prevent seepage. The Tassel soil is generally not suited to lagoons. Both soils are generally suitable as sites for dwellings. Excavation of the soft bedrock may be necessary if these soils are used as sites for dwellings with basements. Also, if these soils are used as sites for roads, the soft bedrock may have to be excavated where cuts and fills are needed.

These soils are assigned to capability units IVe-3, dryland, and IVe-8, irrigated. The Busher soil is in the Sandy range site, and the Tassel soil is in the Shallow Limy range site. The Busher soil is in windbreak suitability group 5, and the Tassel soil is in windbreak suitability group 10.

BvF—Busher-Tassel loamy very fine sands, 6 to 30 percent slopes. This map unit consists of deep and shallow, strongly sloping to steep, well drained soils. These soils are on uplands that are dissected by small drainageways. Areas range from 10 to 1,000 acres. The unit ranges from 45 to 60 percent deep Busher soil and from 30 to 40 percent shallow Tassel soil. The Busher soil is on the wider ridgetops and the lower part of side slopes, and the Tassel soil is on convex knolls, on breaks, and on the upper part of the side slopes. The areas of the Busher soil and the areas of the Tassel soils are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Busher soil has a surface layer of dark grayish brown, very friable loamy very fine sand about 8 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 11 inches thick. The underlying material, to a depth of about 58 inches, is pale brown, calcareous loamy very fine sand, and it has many scattered small fragments of sandstone in the lower part. Below this is light gray, calcareous, weakly cemented, limy sandstone. In some areas the soil material is very fine sandy loam or fine sandy loam above the bedrock. In a few areas the dark colored material making up the surface layer is over 20 inches thick; however, in the southwest part of the county, it is generally less than 4 inches thick.

Typically, the Tassel soil has a surface layer of light brownish gray, very friable, calcareous loamy very fine sand about 3 inches thick. The underlying material, to a

depth of about 14 inches, is light gray, calcareous loamy very fine sand. Below this is white, weakly cemented, limy sandstone. Fragments of sandstone rock are common above the bedrock. In some areas the soil material is very fine sandy loam or fine sandy loam above the bedrock. Also, in some places the underlying material is loamy fine sand.

Included with these soils in mapping are small areas of Valent soils and Rock outcrop. Valent soils are coarse in texture and are on higher parts of the landscape than the Busher and Tassel soils. Rock outcrop is on the breaks and in the slightly higher areas. The included areas make up about 10 to 15 percent of the unit.

Permeability of the Busher and Tassel soils is moderately rapid. The available water capacity is moderate in the Busher soil and very low in the Tassel soil. Surface runoff on both soils is medium to rapid, depending on the slope. The organic matter content is moderately low in the Busher soil and low in the Tassel soil. Natural fertility is medium in the Busher soil and low in the Tassel soil. Root development is restricted by the underlying bedrock in areas of the Tassel soil.

Nearly all of the acreage of these soils is in native grass and is used for hayland or rangeland. A few small areas are used as dryfarmed cropland or irrigated cropland.

The soils in this unit are not suited to commonly cultivated crops because of the slope and because of the shallowness of the Tassel soil. Also, in some more sloping areas, there is Rock outcrop.

The soils in this unit are suited to rangeland use. This is an effective way to control both soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

The soils in this unit are generally not suited to trees or shrubs in windbreaks because of the slope and because of the shallowness of the Tassel soil.

Onsite investigation is needed before building sites are planned. These soils generally are not suitable for septic tank absorption fields because of the slope and because of the depth to bedrock in areas of the Tassel soil. A suitable alternate site is needed. Dwellings need to be properly designed to complement the slope, or the soil can be graded. In areas of the Tassel soil, the soft bedrock needs to be considered if dwellings with basements are constructed. If these soils are used as sites for roads, cuts and fills are generally needed to provide a suitable grade and the soft bedrock may have to be excavated in areas of the Tassel soil.

These soils are assigned to capability unit VIe-3, dryland, and windbreak suitability group 10. The Busher soil is in the Sandy range site, and the Tassel soil is in the Shallow Limy range site.

CaF—Canyon very fine sandy loam, 3 to 30 percent slopes. This soil is shallow, gently sloping to steep, and well drained. It is on side slopes and narrow ridgetops of the uplands. Areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The next layer is grayish brown, very friable, calcareous very fine sandy loam about 3 inches thick. The underlying material is light gray, calcareous very fine sandy loam with many small fragments of sandstone. Below this, at a depth of 14 inches, is white, weakly cemented, limy sandstone. In some places, the soil has been eroded and the lighter colored underlying material is at the surface. Also, in some areas the soil is fine sandy loam or loam above the bedrock.

Included with this soil in mapping are small areas of Oglala, Norrest, and Rosebud soils and Rock outcrop. Oglala soils have 40 to 60 inches of soil material over bedrock and have a thicker, darker surface layer than the Canyon soil. Rosebud soils have 20 to 40 inches of soil material over the bedrock and have more clay in the subsoil. The finer textured Norrest soils are moderately deep over clayey siltstone and are on the upper part of side slopes. Rock outcrop is on the breaks and the upper part of side slopes. These inclusions make up about 10 to 15 percent of the unit.

Permeability of this Canyon soil is moderate. The available water capacity is very low. Runoff is medium to rapid, depending on the slope. The organic matter content and natural fertility are low. Root development is restricted by the underlying sandstone.

Nearly all areas of this soil are in native grass and used for hayland and rangeland. A few small areas are used for dryland farming and are generally a part of larger fields of more suitable soils.

This soil is not suited to the common cultivated crops because of the slope and the droughty characteristics of this shallow soil.

The use of this soil for rangeland is an effective way to control soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Brush management may be needed to control woody plants.

This soil generally provides a poor site for trees in windbreaks. Capability for survival and growth of adapted species is poor because of slope, the very low available water capacity, and the shallow rooting zone.

This soil is generally not suited to septic tank absorption fields and sewage lagoons because it is

shallow to bedrock. A suitable alternate site is needed. Excessive slopes are a limitation for building site development. Cuts and fills are generally needed to provide a suitable grade for roads.

This soil is assigned to capability unit VIs-4, dryland, and to the Shallow Limy range site and windbreak suitability group 10.

CbB—Craft very fine sandy loam, 0 to 3 percent slopes. This soil is deep, nearly level and very gently sloping, and well drained. It is on bottom lands along drainageways. This soil is occasionally flooded following heavy rains. Areas are generally long and narrow and range from 5 to about 400 acres.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The next layer is grayish brown, very friable, stratified, calcareous gravelly very fine sandy loam and very fine sandy loam about 3 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous very fine sandy loam. In some places the surface layer is thicker and darker. Also, in some areas the underlying material is loamy very fine sand. In a few places free carbonates are below a depth of 10 inches. In some areas the lower part of the underlying material is strongly alkaline. Weakly cemented, sandstone bedrock is below a depth of 4 feet in a few places.

Included with this soil in mapping are small areas of Duroc, Bankard, and Janise soils. Duroc soils have more clay in the upper part of the underlying material, have a darker surface soil that is over 20 inches thick, and are slightly higher on the landscape than the Craft soil. Bankard soils are coarser in texture in the underlying material and are higher on the landscape. Janise soils have a subsoil, are very strongly alkaline, and are slightly lower on the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Craft soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is medium. This soil is easily tilled throughout a wide range in moisture content.

About one-half of the acreage of this soil is farmed, and the rest is in native grass. Most of the cultivated areas are used for dryland farming.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and legumes. Lack of summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is a hazard where the surface is not adequately protected by crops or crop residue. Occasional flooding is also a hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and conserve moisture. Diversions and dikes can reduce flooding in some areas. The use of cover crops and summer fallow are also suitable practices. Wind stripcropping helps control soil blowing

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, introduced grasses, and alfalfa. This soil is suited to both sprinkler and gravity types of irrigation systems. Soil blowing is the most serious hazard where the surface is not adequately protected by crops and crop residue. Diversions or dikes can protect fields from flooding. A conservation tillage system, such as no-till or eco-fallow, leaves crop residue on the surface and thereby helps prevent soil blowing. Efficient management of irrigation water is important. Some land leveling is generally needed for satisfactory operation of a gravity system. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderate intake rate of this soil. Applying feedlot manure increases infiltration of water and improves fertility, particularly in areas disturbed by land leveling.

The use of this soil for rangeland is an effective way to control soil blowing. Overgrazing by livestock and deposition of silt from flooding reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a suitable site for trees and shrubs in windbreaks. Survival and growth of adapted species is good. Competition for moisture from weeds and grasses can be controlled by cultivation in the tree rows with conventional equipment. Careful use of appropriate herbicides in the row and hand hoeing or rototilling also help control weeds. Drought is the principal hazard when planting trees. Supplemental watering of seedlings may be needed. Planting a cover crop between the rows in late summer helps control soil blowing during fall and early spring. Species of plants need to be selected that can tolerate a calcareous soil condition.

This soil is not suited to use as septic tank absorption fields or as a site for buildings because of flooding. A suitable alternate site is needed. Sewage lagoons need to be lined or sealed to prevent seepage and need dikes for protection from flooding. Roads need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser grained material for subgrade or base material can be used to ensure better performance. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage.

This soil is assigned to capability units IIw-4, dryland, and IIw-6, irrigated, and to the Silty Overflow range site and windbreak suitability group 1L.

Ce—Creighton very fine sandy loam, 0 to 1 percent slopes. This soil is deep, nearly level, and well

drained. It is on uplands, on broad stream terraces, and in narrow upland valleys. Areas range from 5 to 100 acres.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 11 inches thick. The subsoil is very friable very fine sandy loam about 11 inches thick. It is grayish brown in the upper part and light brownish gray and calcareous in the lower part. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In a few places the upper part of the surface layer is fine sandy loam, and in places the dark material making up the surface layer is over 20 inches thick. In about one-half of the areas, free carbonates are at a depth of 20 to 36 inches. In some places sandstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance soils. Alliance soils have more clay in the subsoil, are 40 to 60 inches deep to bedrock, and are higher on the landscape than the Creighton soil. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Creighton soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. Tilth is good throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Many of these areas are irrigated. The remaining acreage is mainly in native grass and is used for grazing and as hayland.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is the most serious hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and conserve soil moisture. Wind stripcropping and summer fallow and the use of annual cover crops are additional practices.

If irrigated, this soil is suited to corn, field beans, sugar beets, potatoes, introduced grasses, and alfalfa. Soil blowing is the principal hazard. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and thereby help prevent soil blowing and conserve soil moisture. This soil is suited to both gravity and sprinkler types of irrigation systems. Some land leveling is generally needed before a gravity system can function properly. Irrigation systems need to be designed so that the rate of application of water does not exceed the moderate intake rate of this soil.

This soil is suited to rangeland use, which is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species generally have good survival and show fair growth if competing vegetation is controlled or removed. This can be accomplished by good site preparation and by timely cultivation or application of appropriate herbicides. Drought is the principal hazard for young trees, and supplemental watering of the seedlings may be needed during periods of insufficient rainfall.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings and roads and streets. Sewage lagoons need to be sealed or lined to prevent seepage.

This soil is assigned to capability units IIc-1, dryland, and I-6, irrigated, and to the Silty range site and windbreak suitability group 3.

CeB—Creighton very fine sandy loam, 1 to 3 percent slopes. This soil is deep, very gently sloping, and well drained. It is on uplands and stream terraces and in narrow valleys of the uplands. Areas range from 5 to 600 acres.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsoil is very friable very fine sandy loam about 12 inches thick. It is brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous very fine sandy loam. In some areas the surface layer is more than 20 inches thick, and in a few places it is less than 5 inches thick. Also, in a few places the subsoil and the upper part of the underlying material are loam. In about one-half of the areas, free carbonates are at a depth of 20 to 36 inches. In some places the surface layer is fine sandy loam, and in some areas sandstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance and Sarben soils. Alliance soils have more clay in the subsoil and are generally slightly lower on the landscape than the Creighton soil. Sarben soils are slightly coarser, have a thinner surface layer, and are slightly higher on the landscape. The included soils make up about 5 to 15 percent of the unit.

This Creighton soil has moderate permeability and a high available water capacity. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. The soil is easily tilled throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Some areas are irrigated, but most are used for dryland farming. The remaining acreage is mainly in native grass.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate

summer rainfall generally limits the selection of cultivated crops that can be successfully grown. Soil blowing is the most serious hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and conserve soil moisture. Wind stripcropping and summer fallow and the use of annual cover crops are additional practices.

If irrigated, this soil is suited to corn, field beans, sugar beets, potatoes, introduced grasses, and alfalfa. Soil blowing is the principal hazard. Conservation tillage practices, such as no-till or eco-fallow, keep residue on the surface, help prevent soil blowing, and conserve moisture. This soil is suited to gravity and sprinkler types of irrigation systems. Some land leveling is needed for satisfactory operation of a gravity system. The rate at which irrigation water is applied needs to be regulated so it does not exceed the moderate intake rate of the soil.

This soil is suited to use as rangeland, and this is an effective way to control soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. The survival and growth rates of adapted species are good. Competing weeds and grasses can be controlled by timely cultivation between the tree rows. Hoeing by hand, rototilling, or spraying with appropriate herbicides can control undesirable plants in the rows. An annual cover crop between the rows can reduce soil blowing. Supplemental watering provides needed moisture during periods of insufficient rainfall.

This soil is generally suited to use as septic tank absorption fields and as sites for dwellings, small commercial buildings, and roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage.

This soil is assigned to capability units IIe-1, dryland, and IIe-6, irrigated, and to the Silty range site and windbreak suitability group 3.

CeC—Creighton very fine sandy loam, 3 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on uplands and stream terraces and in narrow upland valleys. Areas range from 5 to 750 acres.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsoil is brown, very friable very fine sandy loam about 9 inches thick. The underlying material is light gray, calcareous very fine sandy loam in the upper part and very pale brown, calcareous very fine sand in the lower part to a depth of 60 inches. In a few places the subsoil and the upper part of the underlying material are loam. In some areas the dark material making up the surface layer is less than 5 inches thick. In about 50 percent of the area, free carbonates are at a depth of 20 to 36 inches. In some places the surface layer is fine sandy loam or loamy very fine sand. Bedrock is at a depth of 40 to 60 inches in some areas.

Included with this soil in mapping are small areas of Alliance and Sarben soils. Alliance soils have more clay in the subsoil and are generally on lower side slopes than the Creighton soil. The coarser textured Sarben soils are on higher ridgetops and knolls. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Creighton soil is moderate, and the available water capacity is high. Runoff is medium. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. Tilth is good. The soil can be tilled throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Most areas are used for dryland farming; a few areas are irrigated. The remaining acreage is mainly in native grass and is used for grazing.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall limits the selection of cultivated crops that can be successfully grown. Soil blowing and water erosion are serious hazards. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and water erosion and conserve soil moisture. Wind stripcropping and the use of cover crops and summer fallow are additional practices. Terracing can be used on the more uniform slopes to help control water runoff and erosion.

If irrigated, this soil is suited to corn, field beans, sugar beets, potatoes, introduced grasses, and alfalfa (fig. 6). Soil blowing and water erosion are the main hazards. This soil is well suited to sprinkler irrigation systems. The soil can be bench leveled if a gravity system is used. This soil is also suited to gravity systems if contouring and terracing are used with approved conservation tillage practices. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and help prevent both soil blowing and water erosion. If the center-pivot type of sprinkler is used, erosion in the wheel tracks is a problem. The irrigation system needs to be designed so that the rate at which water is applied does not exceed the intake rate of the soil.

This soil is suited to rangeland use, which is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species generally have good survival and growth if competing vegetation is controlled or removed.

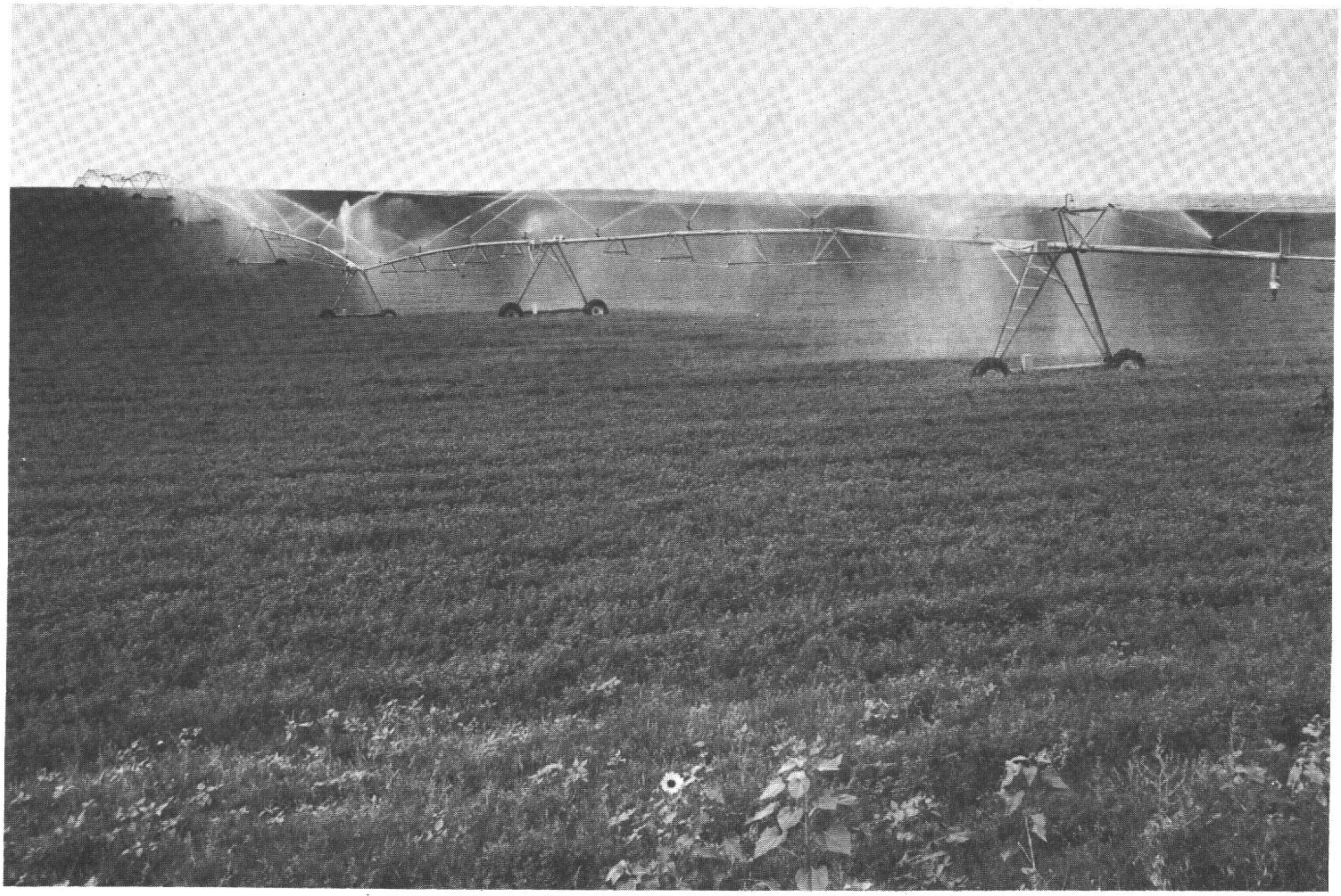

Figure 6.—Growing alfalfa under a center-pivot system on Creighton very fine sandy loam, 3 to 6 percent slopes.

Weeds and undesirable grasses can generally be controlled by timely cultivation or application of appropriate herbicides between the tree rows. Hoeing by hand, rototilling, or chemicals can control undesirable vegetation in the rows. Drought is the principal hazard for young trees, and supplemental watering of the seedlings may be needed. Soil blowing in areas of new plantings can be controlled by planting a cover crop between the rows.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings and roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage, and some grading is required to modify the slope and shape the lagoon. Small commercial buildings need to be properly designed to complement the slope.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-6, irrigated, and to the Silty range site and windbreak suitability group 3.

CeD—Creighton very fine sandy loam, 6 to 11 percent slopes. This soil is deep, strongly sloping, and well drained. It is on uplands and stream terraces and in narrow upland valleys. Areas range from 5 to about 100 acres.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. The subsoil is very friable very fine sandy loam about 10 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In some areas the surface layer is fine sandy loam. The surface layer also is less than 4 inches thick in some areas because of erosion. In about one-half of the areas, free carbonates are at a depth of 20 to 36 inches.

Included with this soil in mapping are small areas of Alliance and Canyon soils. Alliance soils have more clay in the subsoil than the Creighton soil and are generally on the lower part of side slopes. Canyon soils are 8 to 20 inches deep to sandstone and are on the upper part

of side slopes. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Creighton soil is moderate, and the available water capacity is high. Runoff is medium. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. Tilth is good. The soil can be easily tilled throughout a wide range in moisture content.

Over one-half the acreage of this soil is farmed, and the rest is mainly in native grass. Most cultivated areas are used for dryland farming.

If used for dryland farming, this soil is poorly suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall limits the selection of cultivated crops that can be successfully grown. Soil blowing and water erosion are the principal hazards. Conservation tillage practices, such as stubble mulching and eco-fallow, keep all or most of the crop residue on the surface and help control soil blowing and water erosion and also conserve soil moisture. Terraces and grassed waterways can be used on the more uniform slopes to help control water erosion. Wind stripcropping, summer fallow, and the use of annual cover crops are also suitable practices on this soil.

If irrigated, this soil is poorly suited to introduced grasses and alfalfa. It is generally not suited to row crops because of the water erosion hazard. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and thereby help prevent water erosion and soil blowing. If the center-pivot type of irrigation system is used, erosion in the wheel tracks can be a problem. The irrigation system needs to be designed so that the rate at which water is applied does not exceed the moderate intake rate of the soil. If water is applied at a rate faster than the intake rate, severe rilling on the soil can result.

The use of this soil for rangeland is an effective way to control soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species generally have good survival and growth if competing vegetation is controlled or removed. This can be accomplished by good site preparation, by timely cultivation, and by application of appropriate herbicides between the rows. Weeds and grasses in the row can be controlled by herbicides, by hand hoeing, or by rototilling. Drought is the principal hazard when planting young trees, and supplemental irrigation of the seedlings may be needed. Planting trees on the contour in combination with terracing and planting cover crops between the rows can help control erosion.

The use of this soil for septic tank absorption fields is limited by slope. Land shaping and installing the absorption field on the contour are generally necessary to help overcome this limitation. If sewage lagoons are constructed, extensive grading is required to modify the slope and shape the lagoon. Lagoons also need to be lined or sealed to prevent seepage. If dwellings are constructed on this soil, they should be designed to complement the slope, or the site should be graded. Cuts and fills are generally needed to provide a suitable grade for roads and streets.

This soil is assigned to capability units IVe-1, dryland, and IVe-6, irrigated, and to the Silty range site and windbreak suitability group 3.

CnD—Creighton-Norrest complex, 6 to 11 percent slopes. This map unit consists of deep and moderately deep, strongly sloping, well drained soils. These soils are on uplands. Most areas are dissected by small drainageways. Areas of this complex range from 5 to 200 acres. The unit ranges from 45 to 60 percent deep Creighton soils and from 25 to 35 percent moderately deep Norrest soils. Creighton soils are on ridgetops and the lower part of side slopes, and Norrest soils are on the upper part of side slopes. The areas of Creighton soils and the areas of Norrest soils are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Creighton soils have a surface layer of dark grayish brown, very friable very fine sandy loam about 9 inches thick. The subsoil is grayish brown, very friable very fine sandy loam about 14 inches thick. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In a few places the surface layer is less than 5 inches thick because of erosion. In some areas the surface layer and subsoil are fine sandy loam. In a few places sandstone bedrock is at a depth of 40 to 60 inches. Also, in about one-half of the acreage, free carbonates are at a depth of 20 to 36 inches.

Typically, the Norrest soils have a surface layer of dark grayish brown, friable, calcareous loam about 4 inches thick. The subsoil is calcareous clay loam about 20 inches thick. It is light brownish gray and firm in the upper part and light gray and very firm in the lower part. Below this is light gray, calcareous clayey siltstone. Small fragments of siltstone are scattered throughout the profile. In some areas fragments of sandstone are common on the surface. In other areas the clayey siltstone is above a depth of 20 inches. In a few places the surface layer is very fine sandy loam, and in some areas the subsoil is clay.

Included with this unit in mapping are small areas of Rosebud and Canyon soils and Rock outcrop. Rosebud soils have more clay in the subsoil than Creighton soils,

have more fine sand in the subsoil than Norrest soils, and are 20 to 40 inches deep over sandstone. They are on the broader ridgetops and the lower part of side slopes. Canyon soils are shallow to bedrock and are on the upper part of side slopes. Rock outcrop is on short, steep breaks. The included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in the Creighton soils and moderately slow in the Norrest soils. The available water capacity is high in the Creighton soils and low in the Norrest soils. The water intake rate for irrigation is moderate in both soils. The organic matter content in the Creighton soils is moderately low, and natural fertility is high. The organic matter content in the Norrest soils is moderately low, and natural fertility is medium. Tilth is good in the Creighton soils and fair in the Norrest soils. In areas of the Norrest soils, the surface tends to crust after hard rains.

Most of the acreage of these soils is in native grass and is used for grazing. The remaining areas are used for dryland farming.

If used for dryland farming, these soils are poorly suited to winter wheat, introduced grasses, and legumes. Erosion is the principal hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, keep crop residue on the surface and thereby help control erosion. Grassed waterways also help prevent serious gullying. Terraces help to conserve water and control erosion. Wind stripcropping and the use of cover crops and summer fallow are additional practices that help conserve water and prevent soil loss.

If irrigated, these soils are poorly suited to introduced grasses and alfalfa. They are suited only to sprinkler systems. Soil blowing and water erosion are the principal hazards. Conservation tillage practices, such as eco-fallow, keep crop residue on the surface and thereby help prevent soil blowing and rilling by water. The rate at which irrigation water is applied needs to be regulated so that it does not exceed the intake rate of the soil. If the center-pivot type of sprinkler system is used, water erosion in wheel tracks is common.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover, cause deterioration of the native grasses, and cause severe water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

Creighton soils are suited to trees and shrubs in windbreaks, but Norrest soils are poorly suited. Adapted species generally show only fair survival and growth. Competing vegetation needs to be controlled or removed. This can be accomplished by good site preparation and timely cultivation between the tree rows. Areas in the row can be rototilled, hoed by hand, or sprayed with an appropriate herbicide. Drought is the principal hazard in establishing young trees, and supplemental watering of seedlings may be needed. Planting trees on the contour and terracing can help control erosion and conserve needed moisture.

Onsite investigation is needed before building sites are planned. Creighton soils are moderately suited to use as septic tank absorption fields; the site should be graded and the pipes should be laid out on the contour. The Norrest soils are poorly suited to septic tank absorption fields, but increasing the size of the absorption field increases the filtering capacity. The Creighton soils are generally suitable as sites for dwellings and buildings. In areas of the Norrest soils, foundations for buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling. Cuts and fills are generally needed to provide a suitable grade for roads. Also, the base material used for roads can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling in areas of the Norrest soils. Coarse-grained material can also be used for subgrade or base material to ensure better performance.

These soils are assigned to capability units IVe-1, dryland, and IVe-6, irrigated. Creighton soils are in the Silty range site, and Norrest soils are in the Limy Upland range site. Creighton soils are in windbreak suitability group 3, and Norrest soils are in windbreak suitability group 4L.

CnF—Creighton-Norrest complex, 11 to 30 percent slopes. This map unit consists of deep and moderately deep, moderately steep and steep, well drained soils on uplands. These soils are generally dissected by small drainageways. Areas of this complex range from 10 to 200 acres. The unit ranges from 40 to 55 percent deep Creighton soils and from 30 to 40 percent moderately deep Norrest soils. Creighton soils are on the lower part of side slopes, and Norrest soils are on the upper part. Areas of these soils are so closely intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Creighton soils have a surface layer of very friable very fine sandy loam about 9 inches thick. It is grayish brown in the upper part and dark grayish brown in the lower part. The subsoil is light brownish gray, very friable, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous very fine sandy loam. In a few areas the surface layer is less than 4 inches thick because of erosion. Also, in some places the surface layer is fine sandy loam. In about 40 percent of the area, free carbonates are at a depth of 20 to 36 inches and sandstone bedrock is at a depth of 40 to 60 inches.

Typically, the Norrest soils have a surface layer of grayish brown, friable, calcareous loam about 5 inches

thick. The subsoil is grayish brown, friable, calcareous clay loam in the upper part and light gray, firm, calcareous clay loam in the lower part. It is about 17 inches thick. The underlying material, to a depth of 29 inches, is light gray, calcareous clay loam. Below this is light gray, calcareous, clayey siltstone. Fragments of siltstone are throughout the profile, and in some places fragments of sandstone are common on the surface. In some places the clayey siltstone is at a depth of 10 to 20 inches. Also, in a few places the surface layer is very fine sandy loam.

Included with this unit in mapping are small areas of Rosebud and Canyon soils and Rock outcrop. Rosebud soils have more clay in the subsoil than Creighton soils, have more fine sand in the subsoil than Norrest soils, are moderately deep over sandstone, and are on the lower part of side slopes. Canyon soils are shallow to bedrock and are on the upper part of side slopes. Rock outcrop is on short, steep breaks. The included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in the Creighton soils and moderately slow in the Norrest soils. The available water capacity is high in the Creighton soils and low in the Norrest soils. Runoff is rapid. Both the Creighton and Norrest soils are moderately low in organic matter content. The Creighton soils are high in natural fertility, and the Norrest soils are medium in natural fertility. Root development is restricted by the underlying clayey siltstone in the Norrest soils.

Nearly all of the acreage of these soils is in native grass. A few small areas, generally areas of the less sloping soils that are better suited to cultivation, are used for dryland farming.

The soils in this unit generally are not suited to cultivated crops, either dryland or irrigated, mainly because of the excessive slope.

These soils are suited to use as rangeland. This use is effective in controlling both soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe gully erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

The soils in this unit are generally not suited to trees or shrubs in windbreaks, mainly because of the slope and also because of the low available water capacity of the Norrest soils.

Onsite investigation is needed before building sites are planned. These soils are generally not suitable for sanitary facilities because of slope. A suitable alternate site is needed. Excessive slope is a limitation for building site development. Roads on the Norrest soils need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material can be used for subgrade or base material to ensure better performance. Also, in areas of the Norrest soils the base material for roads can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling. In areas of the Creighton soils and the Norrest soils, cuts and fills are needed to provide a suitable grade if roads are constructed.

These soils are assigned to capability unit VIe-1, dryland, and to windbreak suitability group 10. The Creighton soils are in the Silty range site, and the Norrest soils are in the Limy Upland range site.

DaB—Dailey loamy sand, 0 to 3 percent slopes. This soil is deep, nearly level and very gently sloping, and somewhat excessively drained. It is on uplands near areas of sandhills. Areas range from 5 to 500 acres.

Typically, the surface layer is grayish brown, very friable loamy sand about 7 inches thick. The subsurface layer is dark grayish brown, very friable loamy sand about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown loamy sand. In some places the dark material making up the surface layer is only 5 to 10 inches thick. Also, in a few areas the surface layer is fine sand. Loamy material is below a depth of 24 inches in some places. In many areas the underlying material is fine sand. In a few places this soil has free carbonates at a depth of 18 to 30 inches.

Included with this soil in mapping are small areas of Jayem and Vetal soils. Jayem soils have more silt and less sand in the subsoil and are slightly lower on the landscape than the Dailey soil. The dark upper horizon in the Vetal soils is more than 20 inches thick. The Vetal soils also have more silt and less sand in the profile and are lower on the landscape. The included soils make up about 5 to 15 percent of the unit.

This Dailey soil has rapid permeability and low available water capacity. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content is moderately low, and natural fertility is medium. The surface layer is easily tilled throughout a wide range in moisture content.

Most of the acreage of this soil is in native grass and is used for grazing or haying. The remaining areas are mainly farmed under sprinkler irrigation systems. Some areas are used for dryland farming.

If used for dryland farming, this soil is poorly suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall commonly limits the selection of crops that can be grown successfully. Soil blowing is the principal hazard. Conservation tillage practices, such as eco-fallow and stubble mulching, help conserve moisture and prevent serious soil blowing. Wind stripcropping helps control soil blowing. Conserving all available moisture is important because the available water capacity is low. Summer fallow is a practice that

conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. This soil is not suited to gravity irrigation systems because of the rapid permeability and the hazard of severe soil blowing. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and help to control soil blowing. Application of water needs to be frequent because of the low available water capacity. Applying excessive amounts of irrigation water to the soil can cause leaching of nutrients.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize some areas of eroded cropland.

This soil provides a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Competing weeds and grasses need to be controlled. Cultivation to control competing vegetation should be restricted to the tree row because of the hazard of soil blowing. Appropriate herbicides can be applied in the row, or the areas can be hoed by hand or rototilled. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Drought is a hazard for seedlings. Supplemental watering provides needed moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by rapid permeability. The contamination of the ground water is a hazard. Sewage lagoons need to be lined or sealed to prevent seepage. This soil is generally suited to use as a site for dwellings and roads and streets. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving.

This soil is assigned to capability units IVe-5, dryland, and IVe-11, irrigated, and to the Sandy range site and windbreak suitability group 5.

DaD—Dailey loamy sand, 3 to 9 percent slopes. This soil is deep, gently sloping and strongly sloping, and somewhat excessively drained. It is on uplands. Areas range from 5 to 200 acres.

Typically, the surface layer is grayish brown, very friable loamy sand about 9 inches thick. The subsurface layer is grayish brown, very friable loamy sand about 7 inches thick. The upper part of the underlying material is brown loamy sand, and the lower part to a depth of 60 inches or more is light gray sand. In some places the dark material making up the surface layer is less than 10 inches thick. In some areas the surface layer is fine sand, and in some areas the lower part of the underlying material is loamy sand. In a few areas free carbonates are at a depth of 18 to 30 inches. Loamy material is below a depth of 24 inches in some places.

Included with this soil in mapping are small areas of Vetal and Busher soils. The Vetal soils have a thicker surface soil, have more clay in the soil profile, and are on a lower part of the landscape than the Dailey soil. Busher soils have more silt and clay in the soil profile and are 40 to 60 inches deep to sandstone. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Dailey soil is rapid, and the available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content is moderately low, and natural fertility is medium. This soil can be easily tilled throughout a wide range in moisture content.

Most of the acreage of this soil is in native grass. The remaining areas are farmed, and most of these are irrigated by the sprinkler method.

This soil is not suited to dryland farming because of the slope and the low available water capacity.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. Soil blowing is the principal hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, keep all or part of the crop residue on the surface and thereby help conserve moisture and prevent serious soil blowing. Conserving the available moisture is important in this soil because of its low available water capacity. Irrigation water should be applied frequently because of the low available water capacity. Fertility can be lost through leaching with the application of excessive amounts of water.

The use of this soil is for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed in some areas to stabilize eroded cropland.

This soil provides a fair site for trees and shrubs in windbreaks, and adapted species show fair growth and survival. Trees need to be planted in a narrow furrow with as little disturbance of the soil cover as possible to prevent soil blowing. Competition from weeds and grasses in the tree row can be controlled by hoeing or by careful use of appropriate herbicides. Sod can be maintained between the rows to control soil blowing. Supplemental watering can provide needed moisture during times of insufficient rainfall.

If this soil is used as septic tank absorption fields, care should be taken to prevent seepage from contaminating the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. This soil is generally suited to use as a site for dwellings and roads and streets. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving.

This soil is assigned to capability units VIe-5, dryland, and IVe-11, irrigated, and to the Sandy range site and windbreak suitability group 7.

DrB—Duroc loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on foot slopes and in slightly concave areas of the uplands. Areas range from 5 to 200 acres.

Typically, the surface layer is grayish brown, friable loam about 5 inches thick. The subsurface layer is grayish brown, friable loam about 30 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous loam. In some areas the surface soil is less than 20 inches thick. In a few areas limy sandstone is at a depth of 40 to 60 inches. In some places the lower part of the surface soil is silty clay loam. In about one-fourth of the area, free carbonates are below a depth of 36 inches.

Included with this soil in mapping are small areas of Scott Variant soils and Vetal soils. Scott Variant soils have a clayey subsoil and are in depressions. Vetal soils have more sand than the Duroc soil. The included soils make up about 5 to 10 percent of the unit.

Permeability of the Duroc soil is moderate, and the available water capacity is high. The organic matter content is moderate, and natural fertility is high. Runoff is slow. The water intake rate for irrigation is moderate. Tilth is generally good, and the soil is easily tilled.

Most of the acreage of this soil is farmed. Both dryland farming and irrigation are important in these areas. A few small areas are in native grass.

If used for dryland farming, this soil is suited to winter wheat, legumes, and introduced grasses for pasture and hay. Soil blowing is the principal hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, keep the crop residue on the surface and thereby help conserve needed soil moisture and help prevent soil blowing. Wind stripcropping can be used to control soil blowing. Summer fallow is a suitable practice to conserve moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, introduced grasses, and alfalfa. This soil is suited to both gravity and sprinkler types of irrigation systems. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and thereby help prevent soil blowing. An irrigation system needs to be designed so that the rate at which water is applied does not exceed the moderate intake rate of this soil. Some land leveling is needed for the satisfactory operation of a gravity system. Bench leveling is suitable on this soil, or contouring can be used in combination with terracing and conservation tillage practices.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing also can result in soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species generally survive and grow well. Competing vegetation needs to be controlled or removed. This can be accomplished by good site preparation and by timely cultivation or application of appropriate herbicides between the tree rows. Careful use of appropriate herbicides can help control the weeds and grasses in the row. Drought is the principal hazard when trees are planted, and supplemental watering may be needed during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by moderate permeabilty. This limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. This soil is generally suited to use as a site for dwellings and roads and streets.

This soil is assigned to capability units IIe-1, dryland, and IIe-6, irrigated, and to the Silty range site and windbreak suitability group 3.

Du—Duroc loam, occasionally flooded, 0 to 2 percent slopes. This soil is deep, nearly level, and well drained. It is in slightly concave areas of the uplands and in narrow bottom lands of drainageways that cross the uplands. This soil is occasionally flooded following heavy rains. Areas range from 5 to 300 acres.

Typically, the surface layer is grayish brown, friable loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 22 inches thick. The underlying material to a depth of 60 inches or more is grayish brown, calcareous loam. In some areas the surface soil is less than 20 inches thick. Also, in some places the lower part of the surface soil is silty clay loam. In a few places limy sandstone is at a depth of 40 to 60 inches. Also, in about one-fourth of the area, free carbonates are at a depth of 36 to 60 inches.

Included with this soil in mapping are small areas of Lamo Variant, Scott Variant, and Vetal soils. The Lamo Variant soils are poorly drained and in the lower areas along spring-fed drainageways. The Scott Variant soils have a clay subsoil and are in shallow depressions. Vetal soils have more sand and less clay and are slightly

higher on the landscape than the Duroc soil. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Duroc soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderate, and natural fertility is high. Tilth is generally good.

Most of the acreage of this soil is farmed. Both dryland farming and irrigation are important. A few small areas are in native grass.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and legumes. The occasional flooding is the principal hazard. Diversions can reduce flooding in some areas. Conservation tillage practices, such as stubble mulching and eco-fallow, help conserve needed soil moisture and also help prevent soil blowing as well as water erosion following the heavy rains. Wind stripcropping and summer fallow are suitable practices on this soil.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, small grains, alfalfa, and introduced grasses. Both gravity and sprinkler types of irrigation systems can be used on this soil. Under a gravity system, the soil generally needs to be leveled and a suitable grade needs to be established for the system to function properly. Conservation tillage practices, such as no-till and eco-fallow, leave crop residue on the surface and thereby help prevent soil blowing. Diversions and dikes can be used to help control the floodwaters. Returning crop residue to the soil helps increase water infiltration and maintain the organic matter content. The irrigation system needs to be designed so that the rate at which water is applied does not exceed the moderate intake rate of the soil.

The use of this soil for rangeland is effective in controlling erosion. Overgrazing by livestock and deposition of silt reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. Adapted species survive and grow well. Competing weeds and grasses can be controlled by cultivation with conventional equipment between the tree rows. Annual cover crops can be used between the rows. Hand hoeing, rototilling, or careful use of appropriate herbicides can be used in the tree rows.

This soil is not suited to use as septic tank absorption fields or as a site for dwellings or buildings because of occasional flooding. Dikes can protect sewage lagoons from flooding. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIw-4, dryland, and IIw-6, irrigated, and to the Silty Overflow range site and windbreak suitability group 1.

Go—Goshen loam, 0 to 1 percent slopes. This soil is deep, nearly level, and well drained. It is on stream terraces and is subject to rare flooding. Areas range from 10 to 500 acres.

Typically, the surface layer is dark grayish brown, very friable loam about 9 inches thick. The subsoil is 26 inches thick. The upper part is dark grayish brown, friable silty clay loam; the middle part is pale brown, friable silt loam; and the lower part is light gray, very friable, calcareous loam. The underlying material to a depth of 60 inches or more is very pale brown and light gray, calcareous very fine sandy loam. In a few areas the surface layer is very fine sandy loam, and in a few places it is less than 6 inches thick because of land leveling. Also, in some areas the upper part of the subsoil is silt loam or loam. In places the dark material making up the surface layer and upper part of the subsoil is more than 20 inches thick. In a few areas weakly cemented sandstone is at a depth of 48 to 60 inches.

Included with this soil in mapping are small areas of Bridget, McCook, and Satanta soils. Bridget soils have less clay directly beneath the surface layer and are on a slightly lower part of the landscape than the Goshen soil. McCook soils are stratified and are on bottom lands. Satanta soils have more sand and less clay directly beneath the surface layer and are on the higher part of the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Goshen soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is good, and the soil is easily tilled.

Nearly all of the acreage of this soil is farmed. Most areas are irrigated; a few are used for dryland farming. Only a few very small areas are in native grass.

If used for dryland farming, this soil is suited to winter wheat, grasses, and alfalfa for grazing and hay. Lack of summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is a hazard on unprotected soil surfaces. Conservation tillage practices, such as stubble mulching and eco-fallow, keep crop residue on the surface and thereby help prevent soil blowing. Wind stripcropping also helps prevent soil blowing. Summer fallow conserves moisture for use by crops during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard. Conservation tillage practices, such as eco-fallow and no-till, maintain crop residue on the surface and thereby help control soil

blowing. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderately low intake rate of the soil. This soil is well suited to the sprinkler type of irrigation system. Gravity systems are also suitable. If a gravity system is used, some land leveling is generally needed for a uniform distribution of water. Timely application and efficient distribution of irrigation water are needed.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species show good survival and growth. Weeds and undesirable grasses need to be controlled or removed. This can be accomplished by cultivation between the tree rows or by the careful use of appropriate herbicides. In the row or near small trees, hoeing by hand or rototilling can be used to control the undesirable vegetation. Drought is a principal hazard to seedlings and young trees. Supplemental water may be needed during periods of insufficient rainfall.

This soil needs to be protected against the hazard of rare flooding if it is used for sanitary facilities and as a site for buildings. Septic tank absorption fields and sewage lagoons can be protected from flooding by diking. The moderate permeability of this soil is a limitation for septic tank absorption fields, but this can generally be overcome by increasing the size of the absorption field. Sewage lagoons also need to be lined or sealed to prevent seepage. Dwellings and buildings can be constructed if the site is elevated above the flood level with well compacted fill material. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help prevent damage caused by flooding. Road damage from frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, and to the Silty Lowland range site and windbreak suitability group 3.

Hm—Hemingford loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on tablelands of the uplands and in a few upland basins. Areas range from 5 to 500 acres.

Typically, the surface layer is dark grayish brown, friable loam about 10 inches thick. The subsoil is about 15 inches thick. It is grayish brown, firm clay loam in the upper part and light brownish gray, firm, calcareous sandy clay loam in the lower part. The underlying material is light gray sandy clay loam. At a depth of about 42 inches is white, soft, limy sandstone. In some places the surface layer is fine sandy loam. Also, in a few areas the subsoil is loam or silt loam, and the underlying material is light olive gray very fine sandy loam. In some places the dark material making up the surface layer is 20 to 35 inches thick. Sandstone bedrock is at a depth of 30 to 40 inches in some areas.

Included with this soil in mapping are small areas of Manter and Scott Variant soils. The Manter soils are moderately coarse and are generally on a slightly higher part of the landscape than the Hemingford soil. Scott Variant soils are very poorly drained, have a clay subsoil, and are in depressions. The included soils make up about 5 to 10 percent of the unit.

This Hemingford soil has moderately slow permeability and either moderate or high available water capacity, depending on the depth to bedrock. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is generally good.

Most of the acreage of this soil is in cultivated crops. Most areas are used for dryland farming; a few areas are irrigated. The remaining areas are in native grass and are used mainly for grazing.

If used for dryland farming, this soil is suited to winter wheat, alfalfa, and introduced grasses. Inadequate moisture during summer months commonly limits the selection of crops that can be successfully grown. Soil blowing is a hazard if the surface is not adequately protected. Conservation tillage practices, such as stubble mulching and eco-fallow, keep all or part of the crop residue on the surface and thereby help prevent soil blowing and conserve moisture. Summer fallow and wind stripcropping help also.

If irrigated, this soil is suited to introduced grasses, alfalfa, corn, field beans, and sugar beets. This soil is suited to gravity and sprinkler irrigation systems. The principal hazard is soil blowing when the vegetative cover is removed. Conservation tillage practices, such as eco-fallow and no-till, leave crop residue on the soil surface and help control soil blowing. Some land leveling is generally needed for satisfactory operation of a gravity system. The rate at which water is applied should not exceed the moderately low intake rate of this soil. A tailwater recovery system conserves water for reuse on gravity irrigated land.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. For adapted species the survival rate and growth rate are good. Drought and competition for moisture from weeds and grasses are the principal hazards. Seedlings generally survive and grow if the competing vegetation is controlled by timely cultivation between the tree rows. Hand hoeing or rototilling can be used in the row or near small trees. Planting an annual cover crop between the tree rows can reduce soil blowing. Supplemental watering may be needed during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by the depth to bedrock and moderately slow permeability. These limitations can generally be overcome by increasing the size of the absorption area. Sewage lagoons can be constructed in areas of this soil by excavating the sandstone and by sealing the bottom of the lagoon to prevent seepage. The foundations of buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of this soil. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarse-grained material for subgrade or base material can be used to ensure better performance.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, and to the Silty range site and windbreak suitability group 3.

HmB—Hemingford loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is in slightly convex areas of tablelands and on side slopes of the uplands. Areas range from 5 to 300 acres.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is dark grayish brown and is 13 inches thick. The upper part is friable clay loam, and the lower part is firm clay loam. The underlying material is light gray and white, calcareous sandy clay loam that extends to a depth of about 52 inches. Below this is white, weakly cemented, limy sandstone. In some areas the surface layer is fine sandy loam. Also, in a few places the subsoil is loam or silt loam, and the underlying material is very fine sandy loam. In some areas the dark material making up the surface layer is 20 to 30 inches thick. In some places sandstone bedrock is at a depth of 30 to 40 inches.

Included with this soil in mapping are small areas of Manter soils. They have less clay and more sand and are generally on a slightly higher part of the landscape than the Hemingford soil. The inclusions make up about 5 to 10 percent of the unit.

This Hemingford soil has moderately slow permeability and either moderate or high available water capacity, depending on the depth to bedrock. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is generally good.

Most of the acreage of this soil is farmed. Most of the cultivated areas are used for dryland farming; some are irrigated. A few areas are in native grass and are used mainly for grazing.

If used for dryland farming, this soil is suited to winter wheat, alfalfa, and introduced grasses. Water erosion and soil blowing are hazards when the vegetative cover is removed. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and water erosion and also help conserve soil moisture. Terraces, contour farming, and grassed waterways help to control water erosion. Wind stripcropping helps prevent soil blowing. Summer fallow can be used to conserve moisture for use during the following growing season.

Under gravity and sprinkler types of irrigation systems, this soil is suited to introduced grasses, alfalfa, corn, field beans, and sugar beets. Soil blowing is the principal hazard if the soil is tilled. Conservation tillage practices, such as no-till and eco-fallow, leave the crop residue on the surface and thereby help control erosion. Land leveling is needed to achieve the proper grade for a gravity irrigation system. If slopes are uniform, level benches or parallel terraces constructed at the proper grade can help control erosion. A tailwater recovery system conserves water for reuse. Less land preparation is needed if a sprinkler irrigation system is used. The rate at which water is applied should be planned so that it does not exceed the moderately low intake rate of this soil.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover, cause deterioration of the native plants, and cause soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Adapted species show good survival and growth. Drought is the principal hazard. Seedlings generally survive and grow well if weeds and grasses are controlled by timely cultivation between the tree rows. Competing vegetation in the rows can be controlled by rototilling, hoeing by hand, or careful application of appropriate herbicides. Cover crops between the tree rows can also help control both soil blowing and water erosion. Supplemental watering of seedlings and of older trees may be needed to provide moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by the depth to bedrock and moderately slow permeability. These limitations can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of this soil

if the bottom of the lagoon is sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling of the soil. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, and to the Silty range site and windbreak suitability group 3.

HmC—Hemingford loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on convex ridgetops and short side slopes of the uplands. Areas range from 5 to 150 acres.

Typically, the surface layer is dark grayish brown, friable loam about 8 inches thick. The subsoil is light brownish gray, firm clay loam about 9 inches thick. The underlying material is light gray, calcareous sandy clay loam to a depth of about 40 inches. Below this is white, weakly cemented, limy sandstone. In some places this soil is eroded, and the surface layer is less than 4 inches thick. Also, in some areas the surface layer is fine sandy loam. In places the subsoil is loam, and the underlying material is light olive gray very fine sandy loam or fine sandy loam. Sandstone bedrock is at a depth of 30 to 40 inches in some areas.

Included with this soil in mapping are small areas of Manter and Norrest soils. Manter soils have more sand in the subsoil and are generally slightly higher on the landscape than the Hemingford soil. Norrest soils have a thinner surface layer and are 20 to 40 inches deep to clayey siltstone. The included soils make up about 10 to 15 percent of the unit.

This Hemingford soil has moderately slow permeability and either moderate or high available water capacity, depending on the depth to bedrock. Runoff is medium. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is generally good, except in areas where the soil is eroded and tillage equipment has deposited subsoil material on the surface.

Most of the acreage of this soil is farmed. Most areas are used for dryland farming; a few are irrigated. The remaining areas are in native grass and are used for grazing.

If used for dryland farming, this soil is suited to introduced grasses and alfalfa for hay and pasture and to wheat. Lack of sufficient rainfall limits the selection of cultivated crops that can be successfully grown. Soil blowing and water erosion are the principal hazards where the surface is unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, that keep crop residue on the surface help prevent erosion and also help conserve soil moisture. Terracing, grassed waterways, and contour farming help control water erosion. Applications of zinc and phosphate in the severely eroded areas can improve fertility. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the next growing season.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, alfalfa, and introduced grasses. Water erosion is the principal hazard when the soil is tilled. Conservation tillage practices, such as eco-fallow and stubble mulching, keep crop residue on the surface and thereby help to control soil blowing and water erosion and increase infiltration of water. Use of zinc and phosphate and feedlot manure, especially in the eroded areas, helps to keep fertility at a high level. Sprinkler systems need to be planned so that the rate at which water is applied does not exceed the moderately low intake rate of this soil. If a center-pivot type of irrigation system is used, erosion in the wheel track ruts is a problem.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plant community. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Drought and water erosion are the principal hazards. Adapted species show fair growth and survival. Seedlings can survive and grow if weeds and undesirable grasses are controlled or removed by cultivation between the tree rows or by the careful use of selected herbicides. Planting a cover crop between the rows reduces water erosion and soil blowing. Irrigation may be needed to supplement the available moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by depth to bedrock and moderately slow permeability. These limitations can generally be overcome by increasing the size of the absorption field. If sewage lagoons are constructed, grading is required to modify the slope and shape the lagoon. Also, after excavation of the bedrock, the bottom of the lagoon needs to be sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated, and to the Silty range site and windbreak suitability group 3.

Ho—Hoffland fine sandy loam, wet, 0 to 1 percent slopes. This deep, nearly level, very poorly drained soil is in valleys and depressions of the sandhills. This soil is subject to frequent ponding. Areas range from 5 to 75 acres.

Typically, there is about 1 inch of partially decayed organic matter on the surface. The surface layer of the mineral soil is gray, very friable, calcareous fine sandy loam about 5 inches thick. The upper part of the underlying material is light brownish gray and light gray, calcareous loamy fine sand and fine sand; the middle part is dark gray, calcareous fine sandy loam; and the lower part to a depth of 60 inches or more is light brownish gray fine sand. In some places the dark material making up the surface layer is 10 to 18 inches thick. Also, in places the upper part of the underlying material is fine sandy loam or loam. In a few places the surface layer is loamy fine sand or very fine sandy loam.

Included with this soil in mapping are small areas of Ipage, Las Animas, and Marlake soils. Ipage soils are moderately well drained and are higher on the landscape than the Hoffland soil. Las Animas soils are somewhat poorly drained, have more silt and clay in the upper part of the underlying material, and are higher on the landscape. Marlake soils have a high water table that is as much as 2 feet above the surface, and they are also slightly lower on the landscape. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Hoffland soil is rapid, and the available water capacity is low. Runoff is ponded. This soil has a seasonal high water table that ranges from 6 inches above the surface to 12 inches below. The organic matter content is high, and natural fertility is medium.

All of the acreage of this soil is in native grass.

This soil is not suited to farming because the high water table causes frequent ponding.

This soil is suited to rangeland and is used for both grazing and production of native hay. Its best use is hay production. Untimely haying and improper mowing height reduce the protective plant cover and cause deterioration of the native plants.

This soil is not suited to trees or shrubs in windbreaks because the high water table causes frequent ponding.

The use of this soil as a site for sanitary facilities or as a site for buildings is limited by frequent ponding and wetness. Suitable alternate sites are needed. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Constructing roads on suitable, well compacted fill material above the ponding level and providing adequate side ditches and culverts help prevent damage caused by ponding and wetness.

This soil is assigned to capability unit Vw-7, dryland, and to the Wet Land range site and windbreak suitability group 10.

ImG—Imlay-Rock outcrop complex, 11 to 60 percent slopes. This unit is a complex of shallow and very shallow soils and places where bedrock is at the surface. The soils are moderately steep to very steep and are well drained. This unit is on breaks and side slopes of uplands that are deeply dissected by intermittent drainageways. Areas range from 5 to 300 acres. This unit ranges from 45 to 55 percent Imlay soils and from 30 to 40 percent outcrops of sandstone bedrock. The Imlay soils are generally on the upper part of side slopes, and the Rock outcrop is generally on the lower, steeper part of side slopes. The areas of Imlay soils and the areas of Rock outcrop are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Imlay soils have a surface layer of light brownish gray, friable, calcareous loam about 3 inches thick. The underlying material, to a depth of 12 inches, is light brownish gray, firm, calcareous clay loam. Beneath this is light olive gray, calcareous clayey siltstone. Fragments of siltstone are common on the surface and are scattered throughout the soil profile in most areas.

Typically, Rock outcrop consists of light gray or white, hard sandstone bedrock that is exposed at the surface. In places there is 1 to 6 inches of soil material over bedrock.

Included with this unit in mapping are small areas of Canyon and Norrest soils. Canyon soils have sandstone bedrock at a depth of 8 to 20 inches, have less clay in the underlying material, and are on the lower part of side slopes, below the Imlay soils. Norrest soils, which are below the Imlay soils on the landscape, are moderately deep to bedrock. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Imlay soils is slow, and the available water capacity is very low. Runoff is rapid. The organic matter content and natural fertility are low. Development of plant roots is restricted to the soil material above the clayey siltstone.

All the acreage of these soils is in native grass and is used for rangeland. Most areas support only a scarce amount of vegetation.

The soils in this unit are not suited to cultivated crops or to trees and shrubs in windbreaks because of the combination of steep slopes, very low available water capacity of the Imlay soils, and high percentage of Rock outcrop.

The soils are suitable for rangeland, and the native grasses are effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective cover and causes deterioration of the native plants. Natural vegetation can be kept in the best condition possible on these slopes by proper grazing

use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Brush management may be needed to control undesirable woody plants on the steeper slopes.

The soils in this unit are not suited to use as sites for sanitary facilities because of the slope, the shallowness to bedrock, and the many areas of Rock outcrop. A suitable alternate site is needed. Excessive slopes are a limitation for building site development. The soft bedrock needs to be excavated if roads are constructed. Cuts and fills are needed to provide a suitable grade for roads.

This map unit is assigned to capability unit VIIe-1, dryland, and windbreak suitability group 10. The Imlay soils are in the Shallow Limy range site. Rock outcrop is not assigned to a range site.

IpB—Ipage loamy fine sand, alkali substratum, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil is in sandhills and commonly along the margins of upland valleys. This soil is subject to rare flooding. Areas range from 5 to about 600 acres.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 6 inches thick. The next layer is grayish brown, very friable loamy fine sand about 7 inches thick. The upper part of the underlying material is pale brown, calcareous loamy fine sand, and the lower part to a depth of 60 inches or more is grayish brown and light gray, calcareous loamy fine sand. The soil is very strongly alkaline below a depth of 35 inches. In some areas the underlying material is loamy very fine sand. Also, in places the surface layer is 10 to 18 inches thick. In a few areas the soil is fine sand throughout the profile.

Included with this soil in mapping are small areas of Janise, Lisco, Valent, and Valentine soils. Janise and Lisco soils have saline-alkali characteristics higher in the profile, are finer in texture, and are lower on the landscape than the Ipage soil. Valent and Valentine soils are excessively drained, are not affected by saline-alkali characteristics, and are higher on the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Ipage soil is rapid, and the available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The soil has a seasonal high water table at a depth of about 3 to 6 feet. The organic matter content and natural fertility are low. Tilth is only fair because the soil is coarse in texture, but the soil can be tilled throughout a wide range in moisture content.

Most of the acreage of this soil is in native grass. A few areas are used for dryland farming or are irrigated.

If used for dryland farming, this soil is poorly suited to winter wheat, alfalfa, and introduced grasses. Crop selection is limited by the lack of summer rainfall. Soil blowing is a serious hazard where the soil surface is unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, reduce soil blowing and conserve needed soil moisture. Wind stripcropping, summer fallow, and cover crops are also helpful. The saline-alkali condition in the underlying material is toxic to most plant roots and slows the downward growth of roots. The first cutting of alfalfa is generally best. Mixing barnyard manure into the soil helps to maintain and improve the organic matter content and fertility.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. The saline-alkali condition in the substratum limits root growth. Application of irrigation water helps leach these toxic salts downward, but the ground water table generally recharges the salts upward during the winter and spring months. Soil blowing is a serious hazard where the surface is unprotected. Conservation tillage practices, such as no-till, till plant, and eco-fallow, help control soil blowing and conserve water. Keeping crop residue on the soil also helps maintain and improve soil tilth, fertility, and the organic matter content. This soil is best suited to a sprinkler irrigation system. A gravity system is not suitable because the rapid permeability makes distribution of water difficult. Excessive amounts of irrigation water can cause loss of nutrients by leaching. This soil responds well to irrigation and to applications of fertilizer.

The use of this soil for rangeland, either for grazing or haying, is effective in controlling soil blowing. Overgrazing and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. The range can be maintained or improved by proper grazing use and timely deferment of grazing or haying along with restricted use during very wet periods.

This soil provides a poor site for trees and shrubs in windbreaks because of the saline-alkali condition of the underlying material and the coarse soil texture. Adapted species show only fair growth and survival. The species selected should be tolerant of the saline-alkali soil. Competing vegetation can be controlled by cultivation between the rows or by careful use of appropriate herbicides. Hand hoeing or rototilling can be used in the rows. The use of cover crops between the tree rows helps prevent soil blowing. Supplemental water can provide needed moisture during periods of insufficient rainfall.

The hazard of flooding limits this soil for use as sites for sanitary facilities and building sites. Septic tank absorption fields can be constructed on fill material, above the seasonal high water table. Also, care needs to be taken to prevent seepage from contaminating the ground water. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the water table. Also, sewage lagoons need to be lined or sealed to prevent seepage,

and they need dikes for protection from flooding. Dwellings and buildings can be constructed if the site is elevated with well compacted fill material for protection from flooding and from wetness caused by the seasonal high water table. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Damage to roads and streets by frost action can be reduced by providing good surface drainage and by the use of a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IVs-5, dryland, and IVs-11, irrigated, and to the Sandy Lowland range site and windbreak suitability group 9S.

JaB—Janise loamy fine sand, overblown, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, saline-alkali soil is on high bottom lands. It is somewhat poorly drained and is subject to rare flooding. Areas range from 5 to 300 acres.

Typically, the surface layer is dark grayish brown, very friable, calcareous loamy fine sand about 6 inches thick. The subsoil is about 19 inches thick. The upper part is light brownish gray, very friable, calcareous loamy fine sand, and the lower part is grayish brown, friable, calcareous loam. The upper part of the underlying material is light gray and white, calcareous very fine sandy loam. Below this to a depth of 60 inches or more is grayish brown, calcareous loam. The profile is very strongly alkaline above a depth of 50 inches and strongly alkaline between depths 50 and 60 inches. Salinity is moderate throughout most of the soil profile. In some areas the surface layer is fine sandy loam or very fine sandy loam. Also, in places the lower part of the subsoil is silt loam or very fine sandy loam. In a few areas the dark material making up the surface layer is 10 to 15 inches thick. In some areas more than 25 inches of loamy fine sand is over the medium textured part of the profile. The underlying material is fine sandy loam or loamy fine sand in a few places.

Included with this soil in mapping are small areas of Dailey, Ipage, and Valent soils. These soils are all better drained, have more sand in the subsoil and underlying material, and are on higher parts of the landscape than the Janise soil. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Janise soil is rapid in the upper part of the subsoil and moderately slow in the lower part. The available water capacity is moderate. Runoff is slow. This soil has a seasonal high water table at a depth of about 2 to 4 feet. The water intake rate for irrigation is high. The organic matter content and natural fertility are low. This soil contains detrimental amounts of sodium and other salts. The sandy surface layer is easily tilled throughout a wide range in moisture content.

Nearly all of the acreage of this soil is in native grass and is used for haying or grazing. A few areas are used for dryland farming and for irrigated crops.

This soil is not suited to dryland farming because it is very strongly saline-alkali and has a coarse texture.

If irrigated, this soil is poorly suited to corn, sugar beets, alfalfa, field beans, and introduced grasses. The saline-alkali subsoil limits the production of crops, because it is toxic to plant roots. Irrigation water helps leach the toxic salts downward, but the ground water table keeps these salts from being removed from the soil. Soil blowing is a serious hazard where the soil surface is unprotected. Conservation tillage practices, such as eco-fallow or no-till, keep the crop residue on the surface and thereby help control soil blowing and improve the intake of water. A sprinkler irrigation system is best suited to this soil, but gravity systems are also suitable. Land leveling is needed to provide a proper grade and improve surface drainage. Feedlot manure can be used to improve fertility.

This soil is suited to rangeland and is used for either grazing or haying. Overgrazing and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods.

This soil generally provides a poor site for trees or shrubs in windbreaks. Survival and growth are poor. Special procedures, such as hand planting and careful selection of species that can tolerate the very strongly alkaline soil, can be used to establish windbreaks in some places.

This soil needs to be protected against the rare flooding if it is used as a site for buildings. Septic tank absorption fields can be constructed on fill material, above the seasonal high water table. The moderately slow permeability of the soil is a limitation for septic tank absorption fields, but this can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon above the seasonal high water table and the flood level. Sewage lagoons also need to be lined or sealed to prevent seepage. Buildings can be constructed if the site is elevated with well compacted fill material for protection from flooding and from wetness caused by the high water table. Constructing roads on suitable, compacted fill material and providing adequate side ditches and culverts help protect roads from flood damage and wetness. The use of a gravel moisture barrier in the subgrade and crowning the roadbed to provide good drainage reduce damage caused by frost action.

This soil is assigned to capability units VIs-5, dryland, and IVs-10, irrigated, and to the Saline Subirrigated range site and windbreak suitability group 10.

JcB—Janise loamy fine sand, drained, overblown, 0 to 3 percent slopes. This deep, moderately well drained, nearly level and very gently sloping, saline-alkali soil is on high bottom lands. It is subject to rare flooding. Areas range from 5 to about 350 acres.

Typically, the surface layer is dark grayish brown and grayish brown, very friable loamy fine sand about 12 inches thick. The subsoil is about 17 inches thick. The upper part is light brownish gray, very friable, calcareous loamy fine sand, and the lower part is brown, friable, calcareous loam. The upper part of the underlying material is light gray, calcareous loam. The lower part to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. The soil is mildly alkaline in the upper 12 inches, but it is strongly alkaline and very strongly alkaline between depths of 12 and 60 inches. Salinity is slight or moderate throughout most of the profile. In some places the surface layer is fine sandy loam and very fine sandy loam. In some areas the dark material making up the surface layer is less than 6 inches thick. Also, in places the lower part of the subsoil is very fine sandy loam or silt loam. The underlying material is fine sandy loam and loamy fine sand in some places. Some areas have more than 25 inches of the loamy fine sand overblown material. In some of the lower areas the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Jayem, Satanta, and Valent soils. Jayem, Satanta, and Valent soils are well drained and excessively drained and do not have the saline-alkali features of the Janise soil. Also, the Jayem and Valent soils have more sand and less clay in the lower part of the subsoil and underlying material and are on the higher part of the landscape. Also included are soils that have a saline-alkali fine sandy loam and loamy fine sand surface layer. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Janise soil is rapid in the surface layer and upper part of the subsoil and is moderately slow in the lower part of the subsoil. The available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is high. The seasonal high water table is below a depth of 6 feet. This soil contains detrimental amounts of sodium and other salts. The organic matter content and natural fertility are low. This soil is easily tilled throughout a wide range in moisture content.

Most of the acreage of this soil is in native grass and is used for haying or grazing. The remaining areas are used mainly for dryland farming or are irrigated.

If used for dryland farming, this soil is poorly suited to alfalfa and introduced grasses and winter wheat. The alkali salts in the lower part of the subsoil are toxic to the plant roots and slow their growth. Soil blowing is also a serious hazard on unprotected surfaces. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and conserve needed moisture. Use of feedlot manure helps to maintain and improve fertility, soil tilth, and the organic matter content. This soil is droughty in summer. The first cutting of alfalfa is most dependable because it grows and matures in spring, when the amount of rainfall is highest. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is poorly suited to small grasses, corn, sugar beets, alfalfa, field beans, and introduced grasses. The saline-alkali condition in the lower part of the subsoil limits crop production because it inhibits root growth. Application of irrigation water helps leach the toxic salts downward into the underlying material over a period of years. A conservation tillage system, such as no-till or eco-fallow, keeps crop residue on the surface and thereby helps control soil blowing and conserves moisture for use by crops. Additions of feedlot manure help improve fertility, soil tilth, and the organic matter content. This soil is suited to a sprinkler irrigation system. Some land leveling is needed for a gravity system in order to provide a proper grade for good surface drainage. In places the very strongly alkali soil material is exposed at the surface because of leveling operations. Best results can be obtained by selection of alkali-tolerant crops.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. The range can be maintained or improved by proper grazing use and timely deferment of grazing or haying.

This soil provides a poor site for trees and shrubs in windbreaks. Survival and growth rates are only fair. Species that are tolerant of saline-alkali conditions generally survive if the site is properly prepared and if the competing vegetation is controlled. Hoeing by hand, rototilling, or spraying with an appropriate herbicide can control undesirable vegetation in the rows. Cover crops can be used between the tree rows to help control weeds and prevent damage to seedlings from soil blowing. Supplemental water may be needed for young trees during dry periods.

The hazard of rare flooding needs to be considered if this soil is used as a site for sanitary facilities and buildings. The moderately slow permeability of this soil is a limitation for septic tank absorption fields, but this can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and they need dikes for protection from flooding. Dwellings can be constructed if the site is raised with well compacted fill material for protection from flooding. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance.

Also, constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help protect roads from flood damage.

This soil is assigned to capability units IVs-5, dryland, and IVs-10, irrigated, and to the Saline Lowland range site and windbreak suitability group 9N.

Jn—Janise loam, 0 to 2 percent slopes. This deep, somewhat poorly drained, nearly level, saline-alkali soil is on high bottom lands. It is subject to rare flooding. Areas range from 5 to about 600 acres.

Typically, the surface layer is gray, very friable, calcareous loam about 2 inches thick. The subsoil is light brownish gray, calcareous, and about 12 inches thick. The upper part is friable silt loam, and the lower part is very friable loam. The underlying material to a depth of 60 inches or more is light gray, calcareous loam and very fine sandy loam. The soil is very strongly alkaline between depths of 2 and 32 inches and is strongly alkaline between depths of 32 and 60 inches. Salinity is slight or moderate throughout the profile. This soil is mottled below a depth of 32 inches. In some areas the dark material making up the surface layer ranges up to 18 inches in thickness. Also, in places the subsoil is sandy clay loam or very fine sandy loam. In places the underlying material is stratified with layers of sandy loam. Some areas have a surface layer of very fine sandy loam or fine sandy loam.

Included with this soil in mapping are small areas of Dailey and Ipage soils. Dailey soils are sandy, have a thick, dark surface layer, are neutral or mildly alkaline in reaction, and are higher on the landscape than the Janise soil. Ipage soils are sandy, have a strongly alkali substratum, and are slightly higher on the landscape. In some places this soil has a deposit of loamy fine sand on the surface. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Janise soil is moderately slow, and the available water capacity is moderate. Runoff is slow. This soil has a seasonal high water table at a depth of about 2 or 3 feet. The physical condition of this soil, resulting from the alkali salts, slows the intake of water. The organic matter content is moderately low, and natural fertility is low. This soil contains detrimental amounts of sodium and other salts.

Nearly all of the acreage of this soil is in native grass and is used for grazing or haying.

This soil is not suited to the common cultivated crops, either dryland or irrigated, because it is very strongly saline-alkali and has a seasonal high water table that restricts root growth.

This soil is suitable for rangeland, for either grazing or haying. Overgrazing and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Grazing when the soil is wet can cause surface compaction, which slows air and water movement in the soil. Proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods help maintain the native plants in good condition. If areas of this soil are revegetated, plant species that are adapted to the saline-alkali condition should be selected.

This soil generally provides a poor site for trees and shrubs in windbreaks. Capability for survival and growth of plants is poor. In some places windbreaks can be established if special procedures, such as site preparation and hand planting, are used.

The hazard of flooding and the seasonal high water table generally limit the use of this soil as a site for sanitary facilities and as a site for buildings. Damage to roads by frost action can be reduced by providing good surface drainage and by the use of a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability unit VIs-1, dryland, and to the Saline Subirrigated range site and windbreak suitability group 10.

Jo—Janise loam, drained, 0 to 2 percent slopes. This deep, moderately well drained, nearly level, saline-alkali soil is on bottom lands and in alluvial swales. The soil is subject to rare flooding. Areas range from 5 to about 3,500 acres.

Typically, the surface layer is grayish brown, friable, calcareous loam about 2 inches thick. The subsoil is pale brown, friable, calcareous silt loam and loam about 8 inches thick. The upper part of the underlying material is light gray, calcareous very fine sandy loam, and the lower part to a depth of 60 inches or more is grayish brown and light brownish gray, calcareous very fine sandy loam. Typically, this soil is very strongly alkaline in all parts of the profile between depths of 2 and 60 inches. Salinity is slight or moderate throughout most of the profile. In some areas the surface layer and subsoil are very fine sandy loam. Also, in places the dark material making up the surface layer is as much as 15 inches thick. In places the upper part of the underlying material has more clay, but in other places it is fine sandy loam or loamy fine sand. Also, in some areas the subsoil is only moderately alkaline.

Included with this soil in mapping are small areas of Craft, McCook, and Valent soils. These soils do not have saline-alkali characteristics. Craft and McCook soils are well drained. Valent soils are sandy and are on a higher part of the landscape than the Janise soil. Also included are a few irrigated soils that are not so strongly alkaline in the upper 2 feet because of the leaching effect of the irrigation water. Also included are a few areas of Janise loamy fine sand, drained, overblown soil. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Janise soil is moderately slow, and the available water capacity is moderate. Runoff is slow.

The water intake rate for irrigation is moderate. The seasonal high water table is below a depth of 6 feet. The organic matter content is moderately low, and natural fertility is low. This soil contains detrimental amounts of sodium and other salts. The saline-alkali condition of this soil results in poor tilth and slows the intake rate of the water.

Most of the acreage of this soil is in native grass and is used for grazing or haying. Several areas are used for irrigated crops.

This soil is not suited to dryland farming because it is very strongly saline-alkali.

If irrigated, this soil is poorly suited to sugar beets, corn, field beans, alfalfa, and introduced grasses. The main limitation is the saline-alkali condition of the soil. Soil blowing is a slight hazard. Adding feedlot manure and soil amendments, such as gypsum or sulfur, reduces the alkalinity. The irrigation water helps leach the toxic salts to a lower level over a period of years. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and thereby help control soil blowing, conserve moisture, and increase water intake. Chiseling helps increase the infiltration of water. Cover crops help prevent soil blowing. This soil is suited to both sprinkler and gravity types of irrigation systems. Some land leveling is generally needed for gravity systems to provide a proper grade for uniform distribution of water and improved surface drainage.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the native grasses. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and a planned grazing system. If this soil is revegetated, plant species that are adapted to saline-alkali soil conditions should be selected.

This soil generally provides a poor site for trees and shrubs in windbreaks. The survival rate and growth rate are poor. In some areas plantings can be made if special site preparation is applied.

This soil needs to be protected against flooding if it is used as a site for sanitary facilities and buildings. The moderately slow permeability of this soil is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be diked for protection from flooding and need to be lined or sealed to prevent seepage. Buildings and dwellings can be constructed if the proper site is selected and if the site is elevated with well compacted fill material for protection from flooding. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage. Damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help provide the needed surface drainage.

This soil is assigned to capability units VIs-1, dryland, and IVs-6, irrigated, and to the Saline Lowland range site and windbreak suitability group 10.

JsB—Jayem loamy sand, overblown, 0 to 3 percent slopes. This soil is deep, nearly level and very gently sloping, and well drained. It is on uplands where the soil material has been deposited by wind. Areas range from 5 to 100 acres.

Typically, the surface layer is dark grayish brown, very friable loamy sand about 10 inches thick. The subsurface layer is dark grayish brown, very friable loamy fine sand about 18 inches thick. The subsoil is pale brown, friable, calcareous loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In some areas the upper part of the surface layer is fine sand. Also, in some places the surface layer is less than 15 inches thick. The subsoil is sandy clay loam or silt loam in a few places. Some areas have a surface layer that is lighter in color than is typical.

Included with this soil in mapping are small areas of Satanta, Dailey, Valent, and Janise soils. Satanta soils have more silt and clay in the subsoil and are slightly lower on the landscape than the Jayem soil. Dailey soils are coarser in texture and are slightly higher on the landscape. Valent soils have a lighter colored surface layer,contain more sand in the lower part, and are slightly higher on the landscape. Janise soils are strongly alkaline, have more silt and clay in the subsoil, and are lower on the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Jayem soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is high. The organic matter content is moderately low, and natural fertility is medium. This soil can be tilled throughout a wide range in moisture content.

Over one-half the acreage of this soil is farmed. Most of this acreage is used for dryland farming; some is irrigated. The remaining areas are mainly in native grass and are used for grazing.

If used for dryland farming, this soil is poorly suited to winter wheat, alfalfa, and introduced grasses. Drought and soil blowing are the principal hazards where this soil is used for cultivated crops. Conservation tillage practices, such as stubble mulching and eco-fallow, keep all or most of the crop residue on the surface and thereby help control soil blowing and conserve needed soil moisture. Wind stripcropping also helps control soil blowing. Summer fallow stores moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. Soil

blowing is the most serious hazard. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and thereby help control soil blowing. They also help improve the organic matter content and fertility. This soil is best suited to sprinkler irrigation systems because of its high water intake rate. The application of water needs to be timely and frequent because of the sandy surface layer. Applying excessive amounts of water to this soil can cause leaching of nutrients. This soil is suited to gravity systems if a suitable grade has been established for uniform distribution of water and if the length of irrigation runs is kept very short.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss of the surface layer by soil blowing, and the windblown soil can cause crop damage in adjacent areas. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to help stabilize some areas of eroded cropland.

This soil provides a good site for trees and shrubs in windbreaks. The growth and survival rates of adapted species are fair. Weeds and undesirable grasses need to be controlled. This can be accomplished by use of strips of sod or annual cover crops. Soil blowing and drought are the main hazards; therefore, cultivation generally should be restricted to the tree rows. Hoeing by hand, rototilling, or careful use of appropriate herbicides can control undesirable vegetation in the rows. Supplemental watering can provide needed moisture during periods of insufficient rainfall.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings or roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage.

This soil is assigned to capability units IVe-5, dryland, and IIIe-10, irrigated, and to the Sandy range site and windbreak suitability group 5.

JxB—Jayem loamy fine sand, 0 to 3 percent slopes. This deep, level and very gently sloping, well drained soil is on uplands where the soil material is deposited by wind. Areas range from 5 to 350 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is dark grayish brown, very friable loamy fine sand about 9 inches thick. The subsoil is very friable fine sandy loam about 20 inches thick. The upper part is grayish brown, and the lower part is brown. The upper part of the underlying material is pale brown fine sandy loam, and the lower part to a depth of 60 inches or more is light gray, calcareous loamy fine sand. In some areas the surface layer is light colored because of soil blowing. In other areas the dark material making up the surface layer is more than 20 inches thick. Also, in some places the upper part of the subsoil is loamy fine sand. In some areas free carbonates are at a depth of 24 to 36 inches.

Included with this soil in mapping are small areas of Dailey and Satanta soils. Dailey soils have more sand directly beneath the surface layer and are slightly higher on the landscape than the Jayem soil. Satanta soils have more silt and clay in the subsoil and are on a slightly lower part of the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Jayem soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is high. The organic matter content is moderately low, and natural fertility is medium. Tilth is good. The soil can be tilled throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Most of these areas are irrigated; some are used for dryland farming. The remaining areas are mainly in native grass.

If used for dryland farming, this soil is poorly suited to winter wheat, introduced grasses, and alfalfa. Soil blowing is the principal hazard where the surface is not protected by crops or crop residue. A lack of sufficient rainfall is a limitation during most years. Conservation tillage practices, such as stubble mulching and eco-fallow, leave crop residue on the soil surface and thereby help prevent soil blowing, conserve needed soil moisture, and maintain the organic matter content. Wind stripcropping also helps prevent soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses under both the gravity and sprinkler types of irrigation systems. Soil blowing is the principal hazard where the surface is unprotected. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and thereby help prevent soil blowing and conserve moisture. These practices also help maintain and improve the organic matter content and fertility. Land leveling is needed for gravity systems in order to provide a proper grade for uniform distribution of water. The length of run needs to be short in order to minimize water loss and leaching of nutrients. Land shaping is not needed for a sprinkler type of irrigation system. Applying excessive amounts of water causes loss of nutrients by leaching.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing and in the creation of small blowouts. The range can be maintained or improved by proper grazing use, timely deferment of

grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. The survival and growth rates of adapted species are fair. Drought and soil blowing are the main hazards. Supplemental watering can provide needed moisture during periods of insufficient rainfall, and maintaining strips of sod between the tree rows helps to control soil blowing. Competing vegetation has to be controlled or removed. Cultivation or application of selected herbicides generally needs to be restricted to the tree rows in order to minimize soil blowing.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings or roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage.

This soil is assigned to capability units IVe-5, dryland, and IIIe-10, irrigated, and to the Sandy range site and windbreak suitability group 5.

JyB—Jayem fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on uplands where the soil material has been deposited by wind. Areas range from 5 to 500 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is grayish brown, very friable very fine sandy loam about 15 inches thick. The upper part of the underlying material is pale brown, very fine sandy loam, and the lower part to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In a few places the surface layer is light in color because of soil blowing. In other areas the dark material making up the surface layer is more than 20 inches thick. Also, in places the plowed layer is loamy fine sand or very fine sandy loam. In some areas free carbonates are at a depth of 12 to 36 inches. In a few places the lower part of the underlying material is loamy fine sand.

Included with this soil in mapping are small areas of Satanta and Dailey soils. Satanta soils have more clay and silt in the subsoil and are generally slightly lower on the landscape than the Jayem soil. Dailey soils have more sand throughout the profile and are generally slightly higher on the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Jayem soil is moderately rapid, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is medium. Tilth is good. This soil can be tilled throughout a wide range in moisture content.

Most of the acreage of the soil is farmed. Most of this acreage is dryfarmed; some is irrigated. The remaining acreage is in native grass and is used for grazing or haying.

If used for dryland farming, this soil is suited to winter wheat, alfalfa, and introduced grasses for hay and pasture. Drought, in summer, and soil blowing are the principal hazards where the surface is not protected. Conservation tillage practices, such as stubble mulching and eco-fallow, leave crop residue on the surface and thereby help control soil blowing and conserve soil moisture. It also helps maintain and improve the organic matter content and fertility. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

Under the gravity and sprinkler types of irrigation systems, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. Soil blowing is the main hazard where the surface is left unprotected. Conservation tillage practices, such as eco-fallow and no-till, leave crop residue on the surface and thereby reduce soil blowing and conserve moisture. Fertility and organic matter content can be maintained by returning the crop residue to the soil. Land leveling is needed for a gravity system in order to provide a proper grade for uniform distribution of water. The length of run needs to be short in order to minimize loss of water and leaching of nutrients. This soil is suited to a sprinkler type of irrigation system, which does not need land shaping. Nutrients can be lost by leaching if irrigation water is applied in excessive amounts.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. The survival and growth rates of adapted species are fair. Site preparation before seedlings are planted is necessary for good survival. Soil blowing is the principal hazard. Supplemental watering can provide needed moisture during periods of insufficient rainfall. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing. Cultivation generally needs to be restricted to the tree rows.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings or roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage.

This soil is assigned to capability units IIIe-3, dryland, and IIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

JyC—Jayem fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on

uplands where the soil material has been deposited by wind. Areas range from 7 to 75 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 13 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 11 inches thick. The upper part of the underlying material is brown fine sandy loam, and the lower part is light gray, calcareous loamy fine sand to a depth of 60 inches or more. In some places the plowed layer is loamy fine sand or very fine sand. Also, in some areas the surface layer is light colored because of soil blowing. In some places free carbonates are at a depth of 24 to 36 inches.

Included with this soil in mapping are small areas of Dailey and Satanta soils. Dailey soils are sandy and on a higher part of the landscape than the Jayem soil. Satanta soils have a finer textured subsoil and are on the lower part of the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Jayem soil is moderately rapid, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is medium. Tilth is good. This soil can be tilled throughout a wide range in moisture content.

Over one-half the acreage of this soil is farmed, and the remaining areas are mainly in native grass. Most of the cultivated areas are dryfarmed; a few are irrigated by a sprinkler system.

If used for dryland farming, this soil is poorly suited to winter wheat, introduced grasses, and legumes. Lack of sufficient rainfall is a common limitation. Soil blowing and water erosion are the principal hazards where the surface is not protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, leave crop residue on the surface and thereby help prevent soil blowing, conserve moisture, and help maintain the organic matter content and fertility. Wind stripcropping helps control soil blowing. Summer fallow conserves soil moisture for use during the following season. Terraces can be used where the slope is fairly uniform.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. A sprinkler type of irrigation system can be used without land shaping. This soil is not suited to a gravity type of irrigation system. Soil blowing and water erosion are the principal hazards where the surface is not protected. Conservation tillage practices, such as stubble mulching, leave crop residue on the surface and thereby reduce soil blowing and water erosion. Returning crop residue to the soil also helps maintain fertility, organic matter content, and tilth. Crops generally respond well to irrigation. Careful management of the irrigation water is needed. Application of excessive amounts of irrigation water can cause leaching of nutrients below the root zone.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

The soil provides a good site for trees and shrubs in windbreaks. The survival rate and growth rate are fair. Competing vegetation needs to be controlled or removed. Drought and soil blowing are the principal hazards. Irrigation can provide supplemental moisture during periods of insufficient rainfall. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing. Cultivation generally needs to be restricted to the tree row in order to minimize soil blowing.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings and roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage.

This soil is assigned to capability units IVe-3, dryland, and IIIe-8, irrigated and to the Sandy range site and windbreak suitability group 5.

Ke—Keith loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on loess-covered uplands. Areas range from 5 to about 1,000 acres.

Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is grayish brown, friable silty clay loam; the middle part is brown, friable silt loam; and the lower part is very pale brown, friable, calcareous silt loam. The underlying material to a depth of 60 inches or more is very pale brown and white, calcareous very fine sandy loam. A few fine fragments of sandstone are in the lower part. In a few areas the surface layer is very fine sandy loam. Also, in a few areas it is less than 6 inches thick because of land leveling. In some places the subsoil is loam. In small areas limy sandstone is at a depth of 40 to 60 inches. In places the dark material making up the surface layer and the upper part of the subsoil is more than 20 inches thick.

Included with this soil in mapping are areas of Creighton, Scott Variant, and Satanta soils. Creighton soils have more sand and less clay in the subsoil and generally are slightly higher on the landscape than the Keith soil. Scott Variant soils are very poorly drained, have more clay in the subsoil, and are in depressions. Satanta soils have more sand and less clay in the subsoil and are on about the same position on the landscape. The included soils make up about 5 to 10 percent of the unit.

Figure 7.—A gravity irrigation system being used to irrigate sugar beets on Keith loam, 0 to 1 percent slopes.

This Keith soil has moderate permeability and high available water capacity. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is good.

Most of the acreage of this soil is farmed. About one-half of this unit is irrigated, and the remaining areas are used for dryland farming. Areas not cultivated are mainly in native grass.

If used for dryland farming, this soil is suited to winter wheat, alfalfa, and introduced grasses. Lack of adequate rainfall commonly limits the selection of crops that can be successfully grown. Soil blowing is the principal hazard where the soil surface is unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing and loss of soil moisture by evaporation. Keeping crop residue on the surface and applying feedlot manure help maintain the organic matter content and fertility. Wind stripcropping helps prevent soil blowing. Summer fallow stores moisture for use during the following growing season.

Under the gravity and sprinkler types of irrigation systems, this soil is suited to corn, sugar beets, field beans, wheat, potatoes, alfalfa, and introduced grasses (fig. 7). Soil blowing is the principal hazard on unprotected fields. A conservation tillage system, such as eco-fallow or no-till, leaves crop residue on the surface and thereby helps control soil blowing and conserves soil moisture. The crop residue helps maintain the fertility and organic matter content and also increases the infiltration of water. Some land leveling is generally needed to provide uniform distribution of water and surface drainage for a gravity system. All irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderately low intake rate of this soil. An irrigation tailwater recovery system can be used to save water for reuse.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation

system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. The survival and growth rates of adapted species are good. Soil blowing is the principal hazard. Supplemental watering can provide needed moisture during periods of insufficient rainfall. Weeds and undesirable grasses can be controlled by cultivation between the tree rows. Rototilling, hand hoeing, or careful use of an appropriate herbicide can be used in the row. A cover crop or strips of sod can be planted between the tree rows to help control soil blowing. Trees can be damaged if livestock are allowed in the windbreak.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings with basements. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for dwellings without basements and small commercial buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling of the soil. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, and to the Silty range site and windbreak suitability group 3.

KeB—Keith loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on loess-covered uplands. Areas range from 5 to about 600 acres.

Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 27 inches thick. The upper part is grayish brown, friable silty clay loam; the middle part is brown, friable silt loam; and the lower part is light gray, friable, calcareous silt loam. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface layer is very fine sandy loam; in other places it is less than 6 inches thick because of erosion. In some small areas limy sandstone is at a depth of 40 to 60 inches. In a few places the subsoil is loam. In some places the dark material making up the surface layer and the upper part of the subsoil is more than 20 inches thick.

Included with this soil in mapping are small areas of Creighton, Scott Variant, and Satanta soils. Creighton soils have less silt and clay and more sand in the subsoil and generally are on a slightly higher part of the landscape than the Keith soil. Scott Variant soils have more clay in the subsoil, are very poorly drained, and are in depressions. Satanta soils have more sand and less clay in the subsoil and are on about the same position on the landscape. The included soils make up about 5 to 15 percent of the unit.

This Keith soil has moderate permeability and high available water capacity. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is good.

Most of the acreage of this soil is farmed. About one-half of the cultivated areas are used for dryland farming, and the remaining areas are irrigated. A few areas are in native grass and are used for grazing.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate rainfall generally limits the selection of cultivated crops that can be successfully grown and is sometimes insufficient for good crop growth. Soil blowing is the principal hazard on unprotected soil surfaces, and water erosion is a moderate hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, keep crop residue on the surface and thereby help to conserve the needed soil moisture. These practices also help prevent soil blowing and water erosion following heavy rains. The crop residue also helps maintain the organic matter content, fertility, and good tilth. Terraces, contour farming, and wind stripcropping can also be used to control erosion. Summer fallow stores moisture for use during the following growing season.

Under the gravity and sprinkler types of irrigation systems, this soil is suited to sugar beets, field beans, corn, small grains, potatoes, alfalfa, and introduced grasses. Conservation tillage practices, such as no-till or eco-fallow, leave crop residue on the soil surface and thereby help control soil blowing and water erosion, which are the main hazards. The crop residue also helps maintain fertility and the organic matter content and increases infiltration of water. Use of feedlot manure also helps keep fertility at a high level. Contour bench leveling provides a proper grade for uniform distribution of water under a gravity irrigation system. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderately low intake rate of this soil. Where the soil has been cut during land leveling, zinc, phosphate, and manure can be added to help provide needed fertility and tilth. A tailwater recovery system can save irrigation water for reuse.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing also can result in soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Both soil blowing and water erosion are the principal hazards to seedlings and young trees. A lack of

adequate rainfall is a common concern. Adapted species show fair growth and good survival. Competing vegetation needs to be controlled by cultivation between the tree rows and careful use of selected herbicides or rototilling in the row. Planting a cover crop between the tree rows helps control both soil blowing and water erosion. Supplemental watering may be needed during periods of insufficient rainfall. Trees can be planted on the contour to reduce water erosion.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings with basements. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for dwellings without basements and small commercial buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling of the soil. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, and to the Silty range site and windbreak suitability group 3.

KeC—Keith loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridgetops and side slopes of the loess-covered uplands. Areas range from 5 to about 100 acres.

Typically, the surface layer is dark grayish brown, very friable loam about 6 inches thick. The subsoil is about 25 inches thick. The upper part is grayish brown, friable silt loam, and the lower part is pale brown, friable, calcareous silt loam. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In places the surface layer is lighter colored and less than 4 inches thick because of erosion. In a few places the surface layer is very fine sandy loam. Some areas have a loam subsoil. In some small areas limy sandstone is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Creighton and Satanta soils. Both soils have more sand and less clay in the subsoil and are on about the same position on the landscape. The included soils make up about 10 to 15 percent of the unit.

This Keith soil has moderate permeability and high available water capacity. Runoff is medium. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is generally good.

Most of the acreage of this soil is farmed, and most areas are used for dryland farming. A few areas are irrigated. The remaining areas are mainly in native grass.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Lack of adequate rainfall commonly is a limitation to the selection of cultivated crops and crop growth. Soil blowing and water erosion are the principal hazards if the surface is unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, keep crop residue on the surface and thereby help prevent soil blowing and rilling by water and also help conserve soil moisture. The crop residue also helps maintain the organic matter content and fertility and improves soil tilth. Terracing and contour farming reduce runoff and help control erosion. Summer fallow saves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, small grains, sugar beets, alfalfa, and introduced grasses. The main hazard is water erosion. Conservation tillage practices, such as eco-fallow and no-till, leave crop residue on the surface and help to control water erosion and soil blowing. The crop residue also helps maintain the organic matter content and fertility and increases infiltration of water. Sprinkler systems need to be designed so that the rate at which water is applied does not exceed the moderately low intake rate of this soil. If the center-pivot type of sprinkler system is used, erosion in the wheel track ruts can be a problem. Generally, this soil is best suited to the sprinkler system because no land shaping is needed. A gravity system, however, can be used if the soil is bench leveled or if the rows are designed to run across the slope, the land is terraced, and conservation tillage practices are applied.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plant community. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil is suited to trees and shrubs in windbreaks. Lack of adequate rainfall is a common limitation. Water erosion is the principal hazard. Supplemental watering may be needed to provide moisture during periods of insufficient rainfall. The survival and growth rates of adapted species are fair. Weeds and undesirable grasses can be controlled by cultivation between the tree rows or by hand hoeing, rototilling, or use of appropriate herbicides in the row. Planting a cover crop between the rows and planting on the contour can reduce soil blowing and water erosion.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings with basements. Sewage lagoons need to be lined or sealed to prevent seepage, and some grading is required to modify the slope and shape the lagoon. Foundations for dwellings without basements and small commercial buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling of the soil. Also, small commercial buildings

should be properly designed to complement the slope or the soil should be graded. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated, and to the Silty range site and windbreak suitability group 3.

Lc—Lamo Variant loam, 0 to 1 percent slopes. This soil is deep, nearly level, and poorly drained. It is on bottom lands of upland drainageways. This soil is subject to occasional ponding and flooding by runoff from the adjacent higher lying areas. Areas are generally long and narrow and range from 5 to about 100 acres.

Typically, the surface layer is gray, friable loam about 5 inches thick. The subsurface layer is dark gray, friable loam about 32 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous very fine sandy loam. In some places the upper part of the surface soil is fine sandy loam or very fine sandy loam. In places the lower part of the surface soil contains more clay. In a few places weathered sandstone is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Duroc and Scott Variant soils. Duroc soils are well drained and are slightly higher on the landscape than the Lamo Variant soil. Scott Variant soils are very poorly drained, are finer in texture beneath the surface layer, and are in depressional areas on the landscape. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Lamo Variant soil is moderate, and the available water capacity is high. The seasonal high water table fluctuates from 6 inches above the surface to about 2 feet below. Runoff is slow. The organic matter content is moderate, and natural fertility is high.

Most of the acreage of this soil is in native grass and is used for grazing. A few small areas are used for dryland farming or as habitat for wildlife.

This soil is not suited to common cultivated crops, either dryland or irrigated, because of occasional ponding.

This soil is suited to rangeland, either for grazing or haying. Overgrazing and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the natural vegetation. In addition, when the soil is wet, overgrazing can cause surface compaction and small mounds, making it difficult to graze or harvest for hay. Proper grazing use, timely deferment of grazing or haying, and restricted use during wet periods help maintain the native plants in good condition.

This soil is not suited to use as septic tank absorption fields or as a site for dwellings because of flooding and wetness. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. Also, sewage lagoons need dikes for protection from flooding. Roads need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Construction of roads on fill material above the seasonal high water table and the flood level and providing adequate side ditches and culverts help protect roads from flood damage and wetness.

This soil is assigned to capability unit Vw-7, dryland, and to the Wet Subirrigated range site and windbreak suitability group 10.

Ln—Las Animas-Lisco very fine sandy loams, 0 to 2 percent slopes. This map unit consists of deep, nearly level, somewhat poorly drained soils. These soils are on bottom lands and in a few alluvial swales, and they are subject to occasional flooding. Areas of this complex are generally long and narrow and range from 5 to 150 acres. The unit ranges from 45 to 60 percent Las Animas soil and from 30 to 45 percent saline-alkali Lisco soil. The areas of the Las Animas soil and the areas of the Lisco soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Las Animas soil has a surface layer of grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. The next layer is light gray, very friable, calcareous very fine sandy loam about 5 inches thick. The upper part of the underlying material is light gray and pale brown, calcareous loamy very fine sand and very fine sandy loam, and the lower part to a depth of 60 inches or more is light gray fine sand. In some places the surface layer is loamy very fine sand or loamy fine sand. In places the upper part of the underlying material is loam, and in a few areas it is fine sand. In some areas the surface layer is 8 to 12 inches thick.

Typically, the Lisco soil has a surface layer of grayish brown, very friable, calcareous very fine sandy loam about 5 inches thick. The subsoil is light brownish gray, very friable, calcareous loamy very fine sand about 5 inches thick. The upper part of the underlying material is light gray, mottled, calcareous loamy very fine sandy loam, and the lower part to a depth of 60 inches or more is white, calcareous sand with a few pebbles. This soil is strongly alkaline in the surface layer and subsoil and mildly alkaline or moderately alkaline in the underlying material. In some areas the surface layer is loamy very fine sand or loamy fine sand. Also, in a few places the subsoil and the upper part of the underlying material are loam. In a few areas the soil is very strongly alkaline and slightly saline in most of the profile.

Included with these soils in mapping are small areas of Janise and Lisco soils. Janise soils have less fine and coarser sand and more clay in the control section than the Las Animas and Lisco soils. The poorly drained Lisco

soils are on the slightly lower parts of the landscape. The included soils make up about 5 to 10 percent of the unit.

Permeability of the Las Animas and Lisco soils is moderately rapid, and the available water capacity is moderate. The Las Animas soil has a seasonal high water table at a depth of about 1.5 to 3.0 feet. The Lisco soil has a seasonal high water table at a depth of 1.5 to 3.5 feet. The water intake rate for irrigation is moderately high. Runoff is slow. The Lisco soil contains detrimental amounts of sodium and other salts. The organic matter content is moderately low. Natural fertility is medium in the Las Animas soil and low in the Lisco soil. The surface layer and subsoil of the Lisco soil range from strongly alkaline to very strongly alkaline and are slightly saline. The Las Animas soil generally is easily tilled, but the Lisco soil has poor tilth and is not so easy to till.

Nearly all of the acreage of these soils is in native grass. A few small areas are used for dryland farming.

If used for dryland farming, these soils are poorly suited to small grains, alfalfa, and introduced grasses. The main limitations are the wetness in the spring, caused by the seasonal high water table, and the saline-alkali condition of the Lisco soil. The planting of crops and cultivation are often delayed in spring because of the seasonal high water table. Tiling helps to lower the seasonal high water table, but suitable outlets may be difficult to locate. The alkali condition in the surface layer and subsoil of the Lisco soil is toxic to the roots of most crops and slows the downward growth of roots. Keeping crop residue on the surface, applying feedlot manure, and growing legumes improve the fertility balance, tilth, and the organic matter content. Soil blowing is a hazard on unprotected soil surfaces during seasons when crops are not growing. Conservation tillage practices, such as stubble mulching, keep all or most of the crop residue on the surface, help control soil blowing and crusting of the soil surface, and aid infiltration of moisture into the soil.

If irrigated, these soils are poorly suited to introduced grasses and alfalfa. The principal limitations are the saline-alkali condition and the wetness caused by the high water table. Planting is generally delayed until early in the summer because of wetness. Improving the organic matter content and improving the balance of nutrients are concerns of management. They can be accomplished by keeping crop residue on the surface, applying feedlot manure, and using commercial fertilizers. The sprinkler and gravity types of irrigation systems are the most suitable and can be used during the summer after the water table is at its lowest level. Where an outlet is available, tile drains can be installed to lower the water table and make this soil more suitable for other crops, such as corn and sugar beets. Lowering the water table also makes it possible to leach the salts and alkali to lower depths. Soil blowing can be a hazard on unprotected soil surfaces in the fall and spring. Stubble mulching helps prevent soil blowing and crusting of the soil.

The use of these soils for rangeland, either grazing or haying, is effective in controlling soil blowing. Overgrazing and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. In addition, when the soil is wet, overgrazing can cause surface compaction and small mounds, making it difficult to graze or harvest for hay. Proper grazing use, timely deferment of grazing or haying, and restricted use during wet periods help maintain the native plants in good condition.

If these soils are being considered as sites for windbreaks, onsite investigation is needed. The Las Animas soil is suited to sites for windbreaks, but the Lisco soil is poorly suited. The survival and growth rates of adapted species are fair on both soils. In the strongly alkali Lisco soil, root growth is impeded. Establishment of seedlings in the spring is difficult, and planting generally needs to be delayed until the water table is at its lowest level. Undesirable weeds and grasses need to be controlled by cultivation between the rows with conventional equipment or by the careful use of selected herbicides.

These soils are not suited to use as septic tank absorption fields or building sites because of the flooding and wetness. A suitable alternate site is needed. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table, and they need to be lined or sealed to prevent seepage. Sewage lagoons also need to be diked for protection from flooding. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage and wetness.

These soils are assigned to capability units IVs-1, dryland, and IVs-8, irrigated. The Las Animas soil is in the Subirrigated range site, and the Lisco soil is in the Saline Subirrigated range site. The Las Animas soil is in windbreak suitability group 2S, and the Lisco soil is in windbreak suitability group 9S.

Lo—Lisco very fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained, saline-alkali soil. It is mainly on bottom lands and also in a few alluvial swales. This soil is occasionally flooded. Areas range from 5 to about 600 acres.

Typically, the surface layer is grayish brown and light brownish gray, very friable, calcareous very fine sandy loam about 5 inches thick. The subsoil is calcareous, very friable, and light brownish gray and is about 11 inches thick. The upper part is very fine sandy loam, and the lower part is loamy very fine sand. The upper part of the underlying material is light brownish gray, calcareous loamy very fine sand, and the lower part to a depth of 60 inches or more is gray and light gray, calcareous loam

and very fine sandy loam. This soil is very strongly alkaline above a depth of 44 inches and strongly alkaline between depths of 44 and 60 inches. In some areas the surface layer is darker and more than 8 inches thick. Also, in places the surface layer and subsoil are loam, and in a few places the surface layer is loamy fine sand. In some areas the underlying material is loamy fine sand or fine sand.

Included with this soil in mapping are small areas of wet Lisco very fine sandy loam and areas of Ipage and Las Animas soils. The wet Lisco soil is poorly drained and is on the lowest parts of the landscape. Ipage soils are better drained, have a sandy profile, and are on slightly higher positions on the landscape than the Lisco soil. Las Animas soils have a profile that is not saline-alkali. The included areas make up about 10 to 15 percent of the unit.

Permeability of this Lisco soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. The organic matter content is moderately low, and natural fertility is low. This soil contains detrimental amounts of sodium and other salts. This soil has a seasonal high water table at a depth of about 1.5 to 3.5 feet. The saline-alkali condition of this soil results in poor tilth and slows the intake of water.

This soil is not suited to the common cultivated crops, either dryland or irrigated, because it is very strongly saline-alkali.

Nearly all of the acreage of this soil is in native grass and is used for grazing or haying. Overgrazing and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the native grasses. In addition, when the soil is wet, overgrazing can cause surface compaction and small mounds, making it difficult to graze or harvest for hay. Proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods help maintain the native plants in good condition.

This soil generally provides a poor site for trees and shrubs in windbreaks. The survival and growth rates of adapted species are poor. In some places windbreaks can be established if the salinity and alkalinity of the site is reduced and if suitable species of trees are planted.

This soil is not suited to septic tank absorption fields or dwellings because of flooding and wetness . Suitable alternate sites are needed. Sewage lagoons need to be diked for protection from flooding, and they need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage and wetness.

This soil is assigned to capability unit VIs-1, dryland, and to the Saline Subirrigated range site and windbreak suitability group 10.

Lp—Lisco very fine sandy loam, wet, 0 to 1 percent slopes. This deep, nearly level, poorly drained, saline-alkali soil is on bottom lands and in a few alluvial swales. This soil is occasionally ponded. Areas range from 5 to about 300 acres.

Typically, there is about 1 inch of partially decayed organic matter on the surface. The surface layer of the mineral soil is grayish brown, friable, calcareous very fine sandy loam about 4 inches thick. The subsoil is light gray, very friable, calcareous, mottled very fine sandy loam about 11 inches thick. The underlying material to a depth of 60 inches or more is light gray, calcareous, mottled loamy very fine sand. Reaction throughout the profile is typically strongly alkaline. In some places the surface layer is 12 to 18 inches thick. In places the surface layer is silt loam or loam. In some areas the underlying material is loamy fine sand or fine sand. In places the profile is moderately alkaline.

Included with this soil in mapping are small areas of Las Animas and Marlake soils. Las Animas soils are better drained and are on slightly higher parts of the landscape than the Lisco soil. Marlake soils are in very poorly drained depressions and are lower on the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Lisco soil is moderately rapid, and the available water capacity is moderate. This soil has a seasonal high water table 6 inches above the surface to about 18 inches below. Runoff is ponded. The organic matter content is moderately low, and natural fertility is low. This soil contains detrimental amounts of sodium and other salts.

All of the acreage of this soil is in native grass and is used for both grazing and haying.

This soil is not suited to common cultivated crops, either dryland or irrigated, because it is strongly alkaline and subject to ponding.

This soil is suited to rangeland, either for grazing or haying. Overgrazing and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses.

This soil generally provides a poor site for trees or shrubs in windbreaks because of excessive wetness from ponding. In some places species adapted to wetness can be planted with special treatment.

This soil is not suited to use as septic tank absorption fields or as a site for dwellings because of ponding and wetness. A suitable alternate site is needed. Sewage lagoons need to be lined or sealed to prevent seepage. Also, they need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. Constructing roads on suitable, well compacted fill material above the ponding level and providing adequate side ditches and culverts help protect roads from damage by ponding and wetness from the seasonal high water table.

This soil is assigned to capability unit Vw-7,dryland, and to the Wet Land range site and windbreak suitability group 10.

MaB—Manter-Satanta fine sandy loams, 0 to 3 percent slopes. This map unit consists of deep, nearly level and very gently sloping, well drained soils. It is on uplands. Areas of this complex range from 5 to 200 acres. The unit ranges from 40 to 50 percent Manter soil and from 35 to 45 percent Satanta soil. The Manter soil is on the higher parts of the landscape and on knolls, and the Satanta soil is on the lower parts of the landscape. The areas of the Manter soil and the areas of the Satanta soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Manter soil has a surface layer of dark grayish brown, very friable fine sandy loam about 12 inches thick. The subsoil is fine sandy loam about 22 inches thick. It is grayish brown and friable in the upper part and very pale brown, very friable, and calcareous in the lower part. The underlying material to a depth of 60 inches or more is white, calcareous loamy fine sand with a few rock fragments. In some places the surface layer is loamy fine sand. Also, in places the dark material making up the surface layer and the upper part of the subsoil is more than 20 inches thick. In a few places the lower part of the underlying material is fine sand. Also, in places the subsoil has less clay.

Typically, the Satanta soil has a surface layer of dark grayish brown, very friable fine sandy loam about 12 inches thick. The subsoil is grayish brown and is about 19 inches thick. The upper part is very friable fine sandy loam, and the lower part is friable loam. The upper part of the underlying material is gray, calcareous loam, and the lower part to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In some areas the dark material making up the surface layer and upper part of the subsoil is more than 20 inches thick. In other places soil blowing has removed most of the original surface layer, and that layer is lighter in color than typical. Also, in places the surface layer is loamy fine sand. In a few areas the weakly cemented sandstone is at a depth of 40 to 60 inches.

Included with this unit in mapping are small areas of Alliance, Busher, and Hemingford soils. Alliance and Hemingford soils have more silt and clay in the subsoil and are slightly lower on the landscape than the Manter and Satanta soils. Busher soils are 40 to 60 inches deep to weakly cemented sandstone. The included soils make up about 5 to 15 percent of the unit.

Permeability of the Manter soil is moderately rapid, and the available water capacity is moderate. The permeability of the Satanta soil is moderate, and the available water capacity is high. Runoff is slow in both soils. The water intake rate for irrigation is moderately high. The organic matter content is moderately low and natural fertility is high in both soils. Tilth is good. These soils can be tilled throughout a wide range in moisture content.

Most of the acreage of these soils is farmed. Most cultivated areas are used for dryland farming; a few are irrigated. The remaining acreage is mainly in native grass.

If used for dryland farming, these soils are suited to winter wheat, other small grains, alfalfa, and introduced grasses. Inadequate spring and summer rainfall commonly limits the selection of cultivated crops that can be successfully grown. Soil blowing is the principal hazard if the vegetative cover is removed. Conservation tillage practices, such as stubble mulching and eco-fallow, reduce soil blowing and conserve needed soil moisture. The use of cover crops and wind stripcropping help control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, these soils are suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard if the soil surface is not protected. Water erosion is a minor hazard. A conservation tillage practice, such as no-till or eco-fallow, leaves crop residue on the surface to help control erosion. Keeping crop residue on the surface and using feedlot manure help maintain the fertility and organic matter content. These soils are best suited to sprinkler systems because no land shaping is needed and because of the moderately high intake rate. These soils are also suited to a gravity system if the land is bench leveled to provide the proper grade so that movement and intake of water are more uniform. Some nutrients can be lost by leaching if an excessive amount of irrigation water is applied. An irrigation tailwater recovery system can be used to recycle runoff water from a gravity irrigation system.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils provide a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Soil blowing and drought in summer are the principal hazards. Supplemental water may be needed, particularly for seedlings. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Seedlings generally survive and grow if the site has been properly prepared and if the competing vegetation is controlled. Cultivation generally needs to be restricted to the tree rows. Careful use of selected

herbicides also can help control weeds and undesirable grasses.

Onsite investigation is needed before sanitary facilities or sites for buildings are planned or constructed. The Manter soil provides a poor filter for septic tank absorption fields. Care should be taken to prevent seepage from contaminating the ground water. Areas of the Satanta soil are suited to use as septic tank absorption fields. Sewage lagoons in areas of both soils need to be lined or sealed to prevent seepage. These soils are generally suited to use as sites for dwellings. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

These soils are assigned to capability units IIIe-3, dryland, and IIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

MaC—Manter-Satanta fine sandy loams, 3 to 6 percent slopes. This map unit consists of deep, gently sloping, well drained soils. It is on low convex ridges, knolls, and side slopes of the uplands. Areas of this complex range from 5 to 150 acres. The unit ranges from 45 to 55 percent Manter soil and from 30 to 40 percent Satanta soil. The Manter soil is on ridges, knolls, and the upper part of the side slopes, and the Satanta soil is on the lower part of the side slopes. The areas of the Manter soil and the areas of the Satanta soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Manter soil has a surface layer of dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is fine sandy loam about 20 inches thick. It is dark grayish brown and very friable in the upper part and is grayish brown and friable in the lower part. The upper part of the underlying material is very pale brown fine sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray, calcareous loamy fine sand. In a few areas the surface layer is loamy fine sand. In many places erosion has exposed the lighter colored subsoil at the surface. Also, in places the subsoil has less clay and is only 8 to 12 inches thick. In some places the lower part of the underlying material is fine sand.

Typically, the Satanta soil has a surface layer of dark grayish brown, very friable fine sandy loam about 10 inches thick. The subsoil is about 21 inches thick. The upper part is grayish brown, friable fine sandy loam; the middle part is grayish brown, firm clay loam; and the lower part is pale brown, firm sandy clay loam. The underlying material to a depth of 60 inches or more is light gray fine sandy loam. In places the dark material making up the surface layer and the upper part of the subsoil is more than 20 inches thick. In some areas the surface layer is loamy fine sand. In a few areas weakly cemented sandstone is at a depth of 40 to 60 inches.

Included with this unit in mapping are small areas of Busher, Hemingford, Rosebud, and Tassel soils. Busher soils are 40 to 60 inches deep to weakly cemented sandstone. Hemingford soils have more silt and clay in the subsoil and are on a slightly lower part of the landscape than the Manter and Satanta soils. Rosebud soils are 20 to 40 inches deep to weakly cemented, limy sandstone and have more silt and clay in the upper part of the subsoil. Tassel soils are 8 to 20 inches deep to limy sandstone and are on the higher part of the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Manter soil is moderately rapid, and the available water capacity is moderate. Permeability of the Satanta soil is moderate, and the available water capacity is high. Runoff is slow in both soils. The rate of water intake for irrigation is moderately high. The organic matter content is moderately low and natural fertility is high in both soils. Tilth is good. The surface layer is easily tilled throughout a wide range in moisture content.

Most of the acreage of these soils is farmed. Most cultivated areas are in dryland crops; a few are irrigated. The nonfarmed areas are mainly in native grass.

If used for dryland farming, these soils are poorly suited to winter wheat and other small grains and to such hay crops as alfalfa and introduced grasses. Lack of sufficient rainfall in spring and summer commonly limits the selection of cultivated crops. Soil blowing and water erosion are the principal hazards if the vegetative cover is removed. Conservation tillage practices, such as stubble mulching and eco-fallow, reduce the soil blowing and rilling by water and conserve needed soil moisture. The crop residue helps maintain fertility, soil tilth, and the organic matter content. Summer fallow conserves moisture for use during the following growing season. Wind stripcropping aids in reducing soil blowing.

If used for irrigation, these soils are suited to corn, small grains, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. Soil blowing is the most serious hazard if the surface is unprotected. Rilling by water can also be a hazard on these slopes. Conservation tillage practices, such as eco-fallow and no-till, leave crop residue on the surface to help control erosion and conserve moisture. Application of excessive amounts of irrigation water can cause loss of nutrients by leaching. This unit is well suited to the sprinkler type of irrigation system because no land shaping is needed and because of the moderately high intake rate. A gravity system is suitable on these soils, but it is difficult to install because of the large amount of land shaping that is needed.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing. The range can be

maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils provide a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Soil blowing and drought are the principal hazards. Supplemental water may be needed for seedlings. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Competing vegetation in the row can be controlled by timely cultivation. Careful use of appropriate herbicides also helps control weeds.

The Manter soil provides a poor filter for septic tank absorption fields. Care should be taken to prevent seepage from contaminating the ground water. The Satanta soil is suited to use as septic tank absorption fields. On both soils, sewage lagoons need to be lined or sealed to prevent seepage, and some grading is required to modify the slope and shape the lagoon. These soils are generally suited to use as sites for dwellings. Small commercial buildings need to be properly designed to complement the slope, or the soil can be graded. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

These soils are assigned to capability units IVe-3, dryland, and IIIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

Mc—Marlake very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, very poorly drained soil is on bottom lands of streams and in enclosed basins of the sandhills. This soil is frequently ponded. Most areas are roughly oval and range from 5 to 25 acres.

Typically, there is about 2 inches of partly decayed organic matter on the surface. The surface layer of the mineral soil is gray, very friable, calcareous very fine sandy loam about 9 inches thick. The subsurface layer is stratified light brownish gray and gray, very friable, mottled fine sandy loam about 4 inches thick. The next layer is stratified gray and light gray, loose, mottled fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. In some places the surface layer is loamy fine sand. In a few areas the upper part of the underlying material is very fine sandy loam or fine sandy loam.

Included with this soil in mapping are small areas of Hoffland soils and a few intermittent lakes. Hoffland soils are slightly higher on the landscape and commonly surround areas of the Marlake soil. Intermittent lakes have water above the surface for a long enough period to prevent vegetative growth and are lower on the landscape. These inclusions make up about 10 to 15 percent of the unit.

Permeability of this Marlake soil is rapid, and the available water capacity is low. The organic matter content is high, and natural fertility is low. This soil has a seasonal high water table that fluctuates from about 2 feet above the surface to about 1 foot below. Runoff is ponded.

Nearly all of the acreage of this soil is used as habitat for wetland wildlife.

This soil is not suited to cultivated crops because it is generally waterlogged during the growing season. The vegetation is not suitable for grazing. Cattails, tall sedges, rushes, and common reedgrass are the common plant species. The soil is too wet for trees and shrubs for windbreaks.

This soil is not suited to use as septic tank absorption fields or as a site for buildings because of frequent ponding. Alternate sites are needed. If local roads need to cross areas of this soil, they can be constructed on suitable, well compacted fill material above the ponding level. Also, providing roads with adequate side ditches and culverts helps protect them from damage by ponding and wetness.

This soil is assigned to capability unit VIIIw-7, dryland, and to the windbreak suitability group 10.

Md—McCook loam, 0 to 2 percent slopes. This soil is deep, nearly level, and well drained. It is on bottom lands and is occasionally flooded. Areas range from 5 to 400 acres.

Typically, the surface layer is grayish brown, friable, calcareous loam about 12 inches thick. The next layer is light brownish gray, friable, calcareous loam about 8 inches thick. The underlying material to a depth of 60 inches or more is calcareous loam. It is dark grayish brown in the upper part and light brownish gray in the lower part. In some places the free carbonates are below a depth of 10 inches. Also, in some areas the dark material making up the surface layer is more than 20 inches thick. In a few areas the underlying material is strongly alkaline. Also, in places land leveling has exposed the light-colored layer below the surface layer, or the underlying material.

Included with this soil in mapping are small areas of the very strongly alkaline Janise soils in slightly lower areas than the McCook soil. The inclusions make up about 5 to 10 percent of the unit.

Permeability of this McCook soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderate, and natural fertility is high. Tilth is good. This soil is easily tilled throughout a fairly wide range in moisture content.

Nearly all of the acreage of this soil is farmed, and most of it is irrigated. A few small areas are in native grass.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Conservation

tillage practices, such as stubble mulching and eco-fallow, help prevent soil blowing. Flooding is the principal hazard. Diversions and drainage ditches can help control the flooding and reduce crop damage. The crop residue helps maintain the organic matter content, fertility, and tilth. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, potatoes, alfalfa, and introduced grasses. This soil is suited to both sprinkler and gravity types of irrigation systems. Conservation tillage practices, such as no-till and eco-fallow, keep crop residue on the surface and thereby help prevent soil blowing. The rate at which irrigation water is applied needs to be regulated so that it does not exceed the moderate intake rate of the soil. Some land leveling is generally needed to provide good drainage and uniform distribution of water. Drainage ditches can help remove floodwaters in some areas.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and deposition of silt reduces the protective plant cover and causes deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. Adapted species show good survival and growth. Weeds and grasses can be controlled by cultivation with conventional equipment between the rows or by hand hoeing, rototilling, or careful use of appropriate herbicides in the rows. Supplemental water for seedlings may be needed during periods of insufficient rainfall.

This soil is not suited to use as septic tank absorption fields or as a site for dwellings or buildings because of flooding. A suitable alternate site is needed. Sewage lagoons need dikes for protection from flooding. Constructing roads on suitable, well compacted fill material above the flood level and providing adequate side ditches and culverts help protect roads from flood damage. Crowning the road by grading helps provide surface drainage.

This soil is assigned to capability units IIw-4, dryland, and IIw-6, irrigated, and to the Silty Overflow range site and windbreak suitability group 1L.

NoD—Norrest loam, 6 to 11 percent slopes. This moderately deep, strongly sloping, well drained soil is on side slopes of the uplands. It formed from clayey siltstone. Areas range from 5 to 150 acres.

Typically, the surface layer is grayish brown, friable, calcareous loam about 4 inches thick. The subsoil is firm, calcareous clay loam about 17 inches thick. The upper part is grayish brown, and the lower part is light brownish gray. At a depth of about 21 inches is very pale brown, calcareous clayey siltstone. In some places the surface layer is very fine sandy loam. In many places there are common, medium, and coarse fragments of sandstone in the surface layer and subsoil. In some areas the clayey siltstone is above a depth of 20 inches.

Included with this soil in mapping are small areas of Alliance, Creighton, Rosebud, and Canyon soils. Alliance soils have a thicker surface layer than the Norrest soil and are 40 to 60 inches deep to soft sandstone. Creighton soils are deep, have less clay in the subsoil, and have a thicker surface layer. Rosebud soils have more fine sand in the subsoil, are moderately deep over sandstone, and are on the lower part of some side slopes. Canyon soils have less clay and are 8 to 20 inches deep to sandstone bedrock. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Norrest soil is moderately slow, and the available water capacity is low. Runoff is medium. The organic matter content is moderately low, and natural fertility is medium. This soil is tillable throughout a narrow range in moisture content. The surface has a tendency to crust after heavy rains. Root development is restricted by the underlying clayey siltstone.

Most of the acreage of this soil is in native grass and is used for grazing. The rest is cultivated and is used mainly for dryland farming.

If used for dryland farming, this soil is poorly suited to small grains, introduced grasses, and alfalfa. Water erosion is the principal hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, keep most or all of the crop residue on the surface and thereby help prevent water erosion and also conserve soil moisture. Terracing helps to prevent water erosion, but construction of terraces is difficult in many areas because of the uneven slope and the siltstone underlying material that occurs at a moderate depth. Use of feedlot manure helps to improve the organic matter, content, fertility, and tilth and also increases infiltration of water. Summer fallow conserves moisture for use during the following growing season. Wind stripcropping helps control soil blowing.

This soil is generally not suited to irrigation because it is strongly sloping and has low available water capacity and moderately slow permeability.

This soil is suited to rangeland, and grass vegetation is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a poor site for trees and shrubs in windbreaks. Adapted species generally show only fair

growth and survival. Cultivation between the rows and hoeing or application of appropriate herbicides in the row help control competition from weeds and grasses. Drought is the principal hazard for seedlings or young trees, and supplemental watering may be needed. Planting on the contour and terracing help control water erosion.

The use of this soil for septic tank absorption fields is limited by the depth to bedrock and moderately slow permeability. These limitations can generally be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed in areas of this soil if the bottom of the lagoon is sealed to prevent seepage. Extensive grading is also required to modify the slope. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance. Also, the base material can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling.

This soil is assigned to capability unit IVe-1, dryland, and to the Limy Upland range site and windbreak suitability group 4L.

NoF—Norrest loam, 11 to 30 percent slopes. This moderately deep, moderately steep and steep, well drained soil is on side slopes of the uplands. It formed in material weathered from clayey siltstone. Areas range from 5 to about 75 acres.

Typically, the surface layer is grayish brown, friable, calcareous loam about 4 inches thick. The subsoil is light brownish gray, firm, calcareous clay loam about 16 inches thick. The underlying material is light gray, calcareous clay loam. At a depth of 26 inches is very pale brown, calcareous clayey siltstone. In a few places the surface layer is very fine sandy loam. Also, in some areas the siltstone is above a depth of 20 inches. Sandstone rock fragments are scattered throughout the surface layer and subsoil in some areas.

Included with this soil in mapping are small areas of Canyon, Creighton, and Rosebud soils. Canyon soils are shallow over sandstone and have less clay in the profile than the Norrest soil. Creighton soils are deep, have a thicker surface layer, have less clay in the subsoil, and are on the lower part of side slopes. Rosebud soils are moderately deep over sandstone, have more fine sand in the subsoil, and are on the lower part of some side slopes. The included soils make up about 10 to 15 percent of the map unit.

Permeability of this Norrest soil is moderately slow, and the available water capacity is low. Runoff is rapid. The organic matter content is moderately low, and natural fertility is medium. Root development is restricted by the underlying clayey siltstone.

Nearly all the acreage of this soil is in native grass. A few small areas are used for dryland farming.

This soil is not suited to farming, either dryland or irrigated, because of the steepness of slope.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native plants. It also causes severe gully erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil generally provides a poor site for trees or shrubs in windbreaks. The survival rate and growth rate are poor because of the steepness of slope and low available water capacity.

This soil generally is not suitable for sanitary facilities because of the steepness of slope. A suitable alternate site is needed. If dwellings and buildings are constructed on this soil, they should be designed to complement the slope or the site should be graded. Also, foundations need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil. Cuts and fills are generally needed to provide a suitable grade for roads. Roads also need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Also, the base material can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling.

This soil is assigned to capability unit VIe-1, dryland, and to the Limy Upland range site and windbreak suitability group 10.

NpF—Norrest-Canyon complex, 11 to 30 percent slopes. The soils in this map unit are moderately steep and steep and are well drained. The Norrest soils are moderately deep, and the Canyon soils are shallow. This unit is on short to moderately long side slopes along drainageways of the uplands. Areas of this complex range from 10 to 500 acres. The map unit ranges from 40 to 60 percent Norrest soils and from 25 to 40 percent Canyon soils. The Norrest soils are on the upper part of side slopes, and the Canyon soils are on the lower part. The areas of the Norrest soils and areas of the Canyon soils are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Norrest soils have a surface layer of grayish brown, friable, calcareous loam that is about 10 percent sandstone rock fragments and is about 4 inches thick. The subsoil is firm, calcareous clay loam about 18 inches thick. It is pale olive in the upper part and light gray in the lower part. At a depth of 22 inches is very pale brown, calcareous clayey siltstone. In places

sandstone rock fragments are scattered throughout the profile. In some areas the surface layer is very fine sandy loam. Also, in a few places the clayey siltstone is above a depth of 20 inches.

Typically, the Canyon soils have a surface layer of grayish brown, very friable, calcareous very fine sandy loam about 3 inches thick. The next layer is grayish brown, very friable, calcareous very fine sandy loam about 4 inches thick. Small sandstone rock fragments are scattered throughout the surface layer and the layer below that. The underlying material is light gray, calcareous very fine sandy loam. At a depth of 15 inches is white, weakly cemented, limy sandstone. In a few places the soil profile is loam. Also, in some areas erosion has removed the surface layer and exposed the underlying material.

Included with this unit in mapping are small areas of Creighton and Rosebud soils and outcrops of sandstone bedrock. Creighton soils have a thicker, darker surface layer, do not have bedrock above a depth of 60 inches, and are on a lower part of side slopes than the Norrest and Canyon soils. Rosebud soils are 20 to 40 inches deep to sandstone bedrock and have more fine sand in the subsoil than Norrest soils. Rock outcrop is on short breaks. These inclusions make up about 10 to 15 percent of the unit.

Permeability is moderately slow in the Norrest soils and moderate in the Canyon soils. In the Norrest soils the available water capacity is low and natural fertility is medium. In the Canyon soils the available water capacity is very low and natural fertility is low. The organic matter content is moderately low in the Norrest soils and low in the Canyon soils. Root development is restricted by the underlying sandstone and siltstone.

Nearly all of the acreage of these soils is in native grass. A few small areas are used for dryland farming because they are in large fields dominated by soils that are more suitable for cultivation.These soils are generally not suited to farming, either dryland or irrigated, mainly because of the steepness of slope.

These soils are suited to use as rangeland. The use of these soils as rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native grasses. Overgrazing can also result in severe gully erosion from water runoff. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils generally provide a poor site for trees and shrubs in windbreaks because of the steepness of slope and the very low and low available water capacity. The survival rate and growth rate of trees are poor.

These soils are generally not suited to use as septic tank absorption fields and sewage lagoons because of the slope and because of the shallowness of the Canyon soils. If dwellings are constructed on these soils, they should be designed to complement the slope or the site can be graded. In areas of the Canyon soils, the soft bedrock needs to be excavated for construction of dwellings with basements or for buildings that have deep foundations. In areas of the Norrest soils, foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage from shrinking and swelling of the soil. Cuts and fills are generally needed to provide a suitable grade for roads. In areas of the Norrest soils, roads need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Also, the base material can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling. In both soils, the soft bedrock needs to be excavated if roads are constructed.

These soils are assigned to capability unit VIe-1, dryland, and to windbreak suitability group 10. Norrest soils are in the Limy Upland range site, and Canyon soils are in the Shallow Limy range site.

OtD—Oglala-Canyon very fine sandy loams, 3 to 9 percent slopes. This map unit consists of deep and shallow, gently sloping and strongly sloping, well drained soils on uplands. The Oglala soil is on ridgetops and the lower part of side slopes, and the Canyon soil is on the upper part of side slopes. Many areas are dissected by small drainageways. Areas of this complex range from 5 to 400 acres. This unit ranges from 45 to 60 percent deep Oglala soil and from 25 to 35 percent shallow Canyon soil. The areas of the Oglala soil and the areas of the Canyon soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Oglala soil has a surface layer of grayish brown, very friable very fine sandy loam about 8 inches thick. The next layer is brown, very friable very fine sandy loam about 14 inches thick. The underlying material is light gray, calcareous very fine sandy loam. At a depth of 53 inches is white, weakly cemented, limy sandstone. In some places the thickness of the surface layer combined with that of the next layer is less than 15 inches. In a few areas the surface layer and the layer below that are fine sandy loam. In places the surface layer has eroded to less than 4 inches in thickness.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous very fine sandy loam about 6 inches thick. The next layer is light brownish gray, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material is white, calcareous very fine sandy loam. At a depth of 18 inches is white, calcareous, weakly cemented sandstone. Sandstone fragments are in all horizons above the bedrock. In some places the soil is eroded and the light-colored underlying material is at the surface.

Included with this unit in mapping are small areas of Rosebud and Craft soils and outcrops of sandstone bedrock. Rosebud soils are finer in texture than the Oglala and Canyon soils, are moderately deep over soft sandstone, and are on both broad ridgetops and the lower part of side slopes. Craft soils are stratified and on narrow bottom lands. The sandstone outcrop is on short breaks or side slopes. These inclusions make up about 10 to 15 percent of the unit.

Permeability of the Oglala and Canyon soils is moderate. The available water capacity is high in the Oglala soil and very low in the Canyon soil. Runoff is medium on both soils. The water intake rate for irrigation is moderate. The Oglala soil is moderately low in organic matter content and high in natural fertility. The Canyon soil is low in organic matter content and natural fertility. Both soils have good tilth and can be tilled throughout a fairly wide range in moisture content.

About one-half of the acreage of these soils is farmed. Both dryland farming and sprinkler irrigation are practiced. The remaining areas are mainly in native grass.

If used for dryland farming, these soils are poorly suited to winter wheat, introduced grasses, and legumes. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, help conserve soil moisture and also help prevent soil blowing and water erosion. Terraces help prevent water erosion, but are generally difficult to construct because of the uneven slopes and because of the shallowness to bedrock in areas of the Canyon soil. Grassed waterways can be used along some intermittent drainageways to prevent gullying. Summer fallow conserves moisture for use by crops during the following growing season.

If irrigated, these soils are poorly suited to corn, sugar beets, field beans, introduced grasses, and alfalfa. These soils are generally not suited to a gravity irrigation system because a large amount of land shaping is needed and the Canyon soil is shallow. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and thereby help prevent both soil blowing and water erosion. The crop residue helps maintain and improve the organic matter content and fertility and increases water infiltration. Water erosion is a hazard if the rate at which water is applied exceeds the moderate intake rate of the soils. The Canyon soil is droughty and is generally not suited to cultivated crops because of the limited root zone and the low available water capacity. Zinc and phosphate fertilizers increase the fertility in severely eroded areas.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize some areas of eroded cropland.

The Oglala soil is suited to trees and shrubs in windbreaks, but the Canyon soil is generally not suitable because it is shallow. An onsite investigation is needed before a windbreak is planned or planted. Adapted species generally show fair growth and survival on the Oglala soil if competing vegetation is controlled or removed. This can be accomplished by timely cultivation or careful application of appropriate herbicides between the tree rows and by hand hoeing or rototilling in the row. Drought is the principal hazard when trees are planted, and supplemental watering may be needed. Planting trees on the contour can help control water erosion.

Onsite investigation of these areas is needed before buildings sites are planned on these soils. The use of these soils for sanitary facilities is limited by the depth to bedrock and moderate permeability. In areas of the Oglala soil, these limitations can generally be overcome by increasing the size of the absorption field. Sewage lagoons can also be constructed in areas of the Oglala soil if the bottom of the lagoon is sealed to prevent seepage. Grading is also required to modify the slope and shape the lagoon. The Canyon soil is generally not suited to sanitary facilities because it is shallow to bedrock. The Oglala soil is suited to use as sites for dwellings that are designed to complement the slope. In areas of the Canyon soil, the soft bedrock needs to be excavated for construction of dwellings with basements or for buildings that have deep foundations. Damage to roads and streets by frost action can be reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. If roads are constructed in the areas of the Canyon soil, the soft bedrock needs to be excavated.

These soils are assigned to capability units IVe-1, dryland, and IVe-6, irrigated. The Oglala soil is in the Silty range site, and the Canyon soil is in the Shallow Limy range site. The Oglala soil is in windbreak suitability group 3, and the Canyon soil is in windbreak suitability group 10.

OtF—Oglala-Canyon very fine sandy loams, 9 to 30 percent slopes. This map unit consists of deep and shallow, moderately steep and steep, well drained soils on uplands. The Oglala soil is on the lower part of side slopes, and the Canyon soil is on convex ridgetops and the upper part of side slopes. This unit is generally dissected by small drainageways. Areas of this complex range from 10 to 500 acres. This unit ranges from 40 to

55 percent deep Oglala soil and from 30 to 40 percent shallow Canyon soil. The areas of the Oglala soil and the areas of the Canyon soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Oglala soil has a surface layer of grayish brown, very friable very fine sandy loam about 7 inches thick. The next layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The underlying material is pale brown and light gray, calcareous very fine sandy loam. At a depth of about 55 inches is white, weakly cemented, limy sandstone. In some areas the surface layer is less than 4 inches thick, and in places it is fine sandy loam. In some places the layer below the surface layer is not present, and the depth to the underlying material is less than 15 inches.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous very fine sandy loam about 3 inches thick. The next layer is light brownish gray, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material is light gray, calcareous very fine sandy loam. At a depth of about 15 inches is white, weakly cemented, limy sandstone. In places the soil is severely eroded, leaving the lighter colored underlying material at the surface. Sandstone rock fragments are in all horizons above the bedrock.

Included with this unit in mapping are small areas of Rosebud and Craft soils and Rock outcrop. Rosebud soils have more silt and clay above the bedrock, are moderately deep over soft sandstone, and are on the lower part of side slopes. Craft soils are stratified and on narrow bottom lands. Rock outcrop is on short, steep breaks. These inclusions make up about 10 to 15 percent of the unit.

Permeability in the Oglala and Canyon soils is moderate. The available water capacity is high in the Oglala soil and very low in the Canyon soil. Runoff is rapid. The organic matter content is moderately low in the Oglala soil and low in the Canyon soil. Natural fertility is high in the Oglala soil and low in the Canyon soil. Root development is restricted by the underlying sandstone in the Canyon soil.

Nearly all of the acreage of these soils is in native grass and is used for rangeland. A few small areas are used for dryland farming because they are in fields dominated by soils that are suitable for that use.

These soils are generally not suited to farming, either dryland or irrigated, mainly because of the steep slope.

These soils are suited to rangeland use, which is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils are generally not suited to trees or shrubs in windbreaks because of slope and because of the very low available water capacity of the shallow Canyon soil.

An onsite investigation is needed before building sites are planned. These soils are generally not suitable for sanitary facilities because of slope and because of the shallowness to bedrock in the Canyon soil. If dwellings are constructed, they should be designed to complement the slope or the site should be graded. In addition, in areas of the Canyon soil, the soft bedrock needs to be excavated for construction of dwellings with basements or for buildings with deep foundations. Damage to roads by frost action in areas of the Oglala soil can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. In areas of the Canyon soil, the soft bedrock needs to be excavated if roads are constructed. In addition, cuts and fills are generally needed to provide the proper gradient for roads in this unit.

These soils are assigned to capability unit VIe-1, dryland, and to the windbreak suitability group 10. The Oglala soil is in the Silty range site, and the Canyon soil is in the Shallow Limy range site.

Rh—Richfield loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on low-lying uplands. It formed in loess. Areas range from 10 to 1,500 acres.

Typically, the surface layer is grayish brown, friable loam about 8 inches thick. The subsoil is grayish brown, firm silty clay loam in the upper part and pale brown, firm, calcareous silty clay loam in the lower part. It is about 18 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous loam. In some places the subsoil has less clay, and in some areas it is clay loam. Also, in places the surface layer is very fine sandy loam or fine sandy loam.

Included with this soil in mapping are small areas of Duroc soils. Duroc soils have less clay in the surface layer and the layer below that, have a thicker and darker surface layer, and are on a lower part of the landscape than the Richfield soil. Also, included are small areas where land leveling has exposed the lighter colored subsoil. The inclusions make up about 10 percent of the unit.

Permeability of this Richfield soil is moderately slow, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderately low. The organic matter content is moderate, and natural fertility is high. Tilth is good, except in areas where deep plowing and land leveling have brought part of the subsoil to the surface.

Nearly all of the acreage of this soil is farmed, and most of this is irrigated. The few remaining areas are in native grass, and these are generally near farmsteads.

If used for dryland farming, this soil is suited to winter wheat, alfalfa, and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, leave the crop residue on the surface and thereby help prevent soil blowing as well as conserve soil moisture. Returning crop residue to the soil helps maintain the organic matter content, fertility, and tilth of the soil and increases water infiltration. Summer fallow stores moisture for use during the following growing season. Wind stripcropping helps control soil blowing.

If irrigated, this soil is suited to sugar beets, corn, field beans, wheat, alfalfa, potatoes, and introduced grasses. This soil is suited to both sprinkler and gravity types of irrigation systems. Conservation tillage practices, such as eco-fallow and no-till, leave crop residue on the surface and help control soil blowing. The rate at which irrigation water is applied should not exceed the moderately low intake rate of the soil. Land leveling for a gravity system improves surface drainage and provides a proper grade for uniform distribution of water. Deep chiseling improves infiltration of water into the soil. Maximum production can be obtained by using fertilizers, high plant population, and efficient irrigation that controls the amount and time of water application.

This soil is suited to use as rangeland. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil generally provides a good site for trees and shrubs in windbreaks. The survival rate and growth rate are good. Competing vegetation can be controlled by timely cultivation. Careful applications of appropriate herbicides or rototilling can be used in the tree rows. Drought is a hazard for seedlings, and supplemental watering may be needed.

The use of this soil for septic tank absorption fields is limited by moderately slow permeability. This limitation can generally be overcome by increasing the size of the absorption field. This soil is generally suited to use for sewage lagoons. Foundations for buildings need to be strengthened and backfilled with coarse materials to prevent damage from shrinking and swelling of the soil. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil material. Coarser grained material for subgrade or base material can be used to ensure better performance.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, and to the Silty range site and windbreak suitability group 3.

RkG—Rock outcrop-Tassel complex, 11 to 60 percent slopes. This map unit is a complex of a shallow soil and areas where bedrock is at the surface. The slope is moderately steep to very steep. The Tassel soils are somewhat excessively drained. This unit is on breaks and side slopes of the uplands that are deeply dissected by drainageways. Areas of this complex range from 5 to 150 acres. This unit ranges from 50 to 60 percent outcrops of sandstone bedrock and from 30 to 45 percent Tassel soils. The Tassel soils are generally on the lower part of side slopes, and the Rock outcrop generally is on the narrow ridges and upper part of side slopes. The areas of Tassel soils and Rock outcrop are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Rock outcrop is light gray or white, hard, limy sandstone that is exposed at the surface or is covered by less than 6 inches of soil material. Most areas of Rock outcrop are devoid or nearly devoid of vegetation.

Typically, the Tassel soils have a surface layer of grayish brown, very friable, calcareous loamy very fine sand about 3 inches thick. The underlying material is light brownish gray, calcareous loamy very fine sand. At a depth of 12 inches is white, weakly cemented, limy sandstone. Fragments of sandstone are in all horizons above the bedrock. In a few places the surface layer and underlying material are loamy fine sand or very fine sand.

Included with this unit in mapping are small areas of Busher and Valent soils. Busher soils are 40 to 60 inches deep to bedrock and are on foot slopes below the major soils and above the unit on ridges. Valent soils are deep and sandy and on foot slopes below the major soils. The included soils make up about 5 to 10 percent of the unit.

Permeability is moderately rapid in the Tassel soils. The available water capacity is very low. Runoff is very rapid. The organic matter content and natural fertility are low. Plant root development is very restricted in this shallow soil.

All of the acreage of these soils is in native grass and is used for range. Most areas support only a fair amount of vegetation.

This map unit is not suited to farming, either dryland or irrigated, because of the steepness of the slope and the nearness of the bedrock to the surface. This unit also is not suited to trees or shrubs in windbreaks.

The use of the soils in this unit for rangeland is the most effective way to control soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native plants. Proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years help keep the natural vegetation in the best condition possible on these slopes.

The soils in this unit are generally not suited to use as septic tank absorption fields and as a site for dwellings because of the steepness of slope and the shallowness to bedrock. A suitable alternate site is needed. If roads cross areas of this unit, the soft bedrock needs to be excavated. Cuts and fills are also needed to provide a suitable grade for roads.

This unit is assigned to capability unit VIIs-3, dryland, and to windbreak suitability group 10. Rock outcrop is not assigned to a range site. The Tassel soils are in the Shallow Limy range site.

Ro—Rosebud loam, 0 to 1 percent slopes. This soil is moderately deep, nearly level, and well drained. It is on broad divides and tablelands of the uplands. Small fragments of sandstone are scattered over the surface in many areas. Areas range from 5 to 500 acres.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. The subsoil is about 17 inches thick. It is grayish brown, firm clay loam in the upper part and pale brown, friable loam in the lower part. The underlying material is pale brown, calcareous sandy loam. At a depth of about 31 inches is white, weakly cemented, limy sandstone. In a few places the surface layer is very fine sandy loam, and in some areas it is less than 6 inches thick because of land leveling. Also, in places the subsoil has less clay.

Included with this soil in mapping are small areas of Alliance, Canyon, Creighton, and Scott Variant soils. Canyon soils are 8 to 20 inches deep to sandstone bedrock and are slightly higher on the landscape than the Rosebud soil. Alliance soils are 40 to 60 inches deep to bedrock and are generally lower on the landscape. Creighton soils have less clay and more sand in the subsoil, are 60 inches deep or deeper to bedrock, and are lower on the landscape. Scott Variant soils are finer in texture and are in depressions. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Rosebud soil is moderate, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderate, and natural fertility is high. Tilth is good.

Most of the acreage of this soil is farmed. The remaining areas, generally small areas near farmsteads, are in native grass. About one-half of the cultivated areas are used for dryland farming, and the rest are irrigated.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Conservation tillage practices, such as stubble mulching and eco-fallow, help to conserve soil moisture and also help prevent serious soil blowing. Conserving the available moisture is important in this soil because the available water capacity is moderate. The crop residue helps maintain the organic matter content and tilth. Wind stripcropping helps control soil blowing. Summer fallow stores moisture for use during the following growing season.

If irrigated, this soil is suited to corn, field beans, sugar beets, small grains, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and reduce soil blowing. Returning crop residue to the soil increases infiltration of water, especially in areas that have been disturbed during land leveling operations. If land leveling is needed for a gravity system, care should be taken not to expose the underlying bedrock. The rate of application of irrigation water needs to be light and frequent because of the moderate available water capacity and should not exceed the intake rate of the soil. Both sprinkler and gravity types of irrigation systems are suitable.

The use of this soil for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair survival and growth. Competing vegetation can be controlled by cultivation between the tree rows and by hand hoeing, rototilling, or use of appropriate herbicides in the row. The main limitations are the restricted rooting depth and the moderate available water capacity of the soil. Lack of adequate rainfall is a concern, especially with young trees. Supplemental watering can provide additional moisture during periods of insufficient rainfall.

The use of this soil for septic tank absorption fields is limited by the depth to bedrock. Increasing the size of the absorption field generally overcomes this limitation. Sewage lagoons can be constructed in areas of this soil if the bottom of the lagoon is sealed to prevent seepage. This soil is generally suited to use as a site for dwellings without basements. The soft bedrock needs to be excavated for construction of dwellings with basements or for buildings that have deep foundations. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-7, irrigated, and to the Silty range site and windbreak suitability group 6R.

RoB—Rosebud loam, 1 to 3 percent slopes. This moderately deep, very gently sloping, well drained soil is on slightly convex ridgetops and tablelands of the uplands. Small fragments of sandstone are commonly

scattered on the surface. Areas range from 5 to about 600 acres.

Typically, the surface layer is dark grayish brown, friable loam about 7 inches thick. The subsoil is about 17 inches thick. The upper part is grayish brown, firm clay loam, and the lower part is light brownish gray, friable loam. The underlying material is light gray, calcareous very fine sandy loam that has many small sandstone fragments. At a depth of about 35 inches is white, weakly cemented, limy sandstone. In some places the surface layer is less than 4 inches thick because of erosion or land leveling. In a few areas the surface layer is very fine sandy loam. Also, in some places the subsoil is silt loam or very fine sandy loam.

Included with this soil in mapping are small areas of Alliance, Canyon, and Creighton soils. Alliance soils are 40 to 60 inches deep to soft, limy sandstone. Canyon soils are 8 to 20 inches deep to soft, limy sandstone and are generally higher on the landscape than the Rosebud soil. Creighton soils have less silt and clay in the subsoil and are underlain by soft, limy sandstone below a depth of 60 inches. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Rosebud soil is moderate, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderate, and natural fertility is high. The surface layer is generally easily tilled.

Most of the acreage of this soil is dryfarmed; some areas are irrigated. A few areas are in native grass and are used for grazing.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall commonly limits the growth and selection of cultivated crops. Soil blowing is the principal hazard on unprotected surfaces. Water erosion is a minor hazard. Conservation tillage practices, such as stubble mulching and eco-fallow, leave the crop residue on the surface and thereby help conserve needed soil moisture and control soil blowing. Returning crop residue to the soil helps maintain the organic matter content and soil tilth. Wind stripcropping helps prevent soil blowing. Summer fallow stores moisture for use during the next growing season.

If irrigated, this soil is suited to sugar beets, field beans, small grains, corn, potatoes, alfalfa, and introduced grasses. This soil is suited to both sprinkler and gravity types of irrigation systems. Conservation tillage practices, such as no-till and eco-fallow, leave crop residue on the surface and help control soil blowing and water erosion. Returning crop residue to the soil helps maintain soil tilth and the organic matter content and also increases infiltration of water. Contouring is used in combination with gradient terracing for the proper use of a gravity irrigation system. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderate water intake rate of the soil. Application of irrigation water needs to be frequent because of the moderate available water capacity of the soil.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing also can result in soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. The principal limitations are the restricted rooting depth and the moderate available water capacity. Soil blowing and drought are also hazards. Supplemental watering may be needed. Planting a cover crop between the tree rows helps control soil blowing. Competing vegetation in the row needs to be controlled by rototilling, hoeing by hand, or careful use of selected herbicides.

The use of this soil for septic tank absorption fields is limited by depth to bedrock. Increasing the size of the absorption field generally overcomes this limitation. Sewage lagoons can be constructed in areas of this soil if the bottom of the lagoon is sealed to prevent seepage. This soil is generally suited to use as a site for dwellings without basements. The soft bedrock needs to be excavated for construction of dwellings with basements or for buildings that have deep foundations. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-7, irrigated, and to the Silty range site and windbreak suitability group 6R.

RsD—Rosebud-Canyon complex, 3 to 9 percent slopes. This map unit consists of moderately deep and shallow, gently and strongly sloping, well drained soils. These soils are on ridgetops and also on side slopes along drainageways of the uplands. Many areas are long and narrow and range from 5 to about 600 acres. The unit ranges from 45 to 60 percent moderately deep Rosebud soils and from 25 to 40 percent shallow Canyon soils. The Rosebud soils are on the broader ridges and the lower parts of side slopes. The Canyon soils are on the narrow, convex ridges, on knolls, and on the upper part of side slopes (fig. 8). The areas of these soils are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Rosebud soils have a surface layer of dark grayish brown, friable loam about 7 inches thick. The subsoil is about 13 inches thick. The upper part is

Figure 8.—Early growth of winter wheat on Rosebud-Canyon complex, 3 to 9 percent slopes. The light-colored areas are the Canyon soils.

grayish brown, friable clay loam, and the lower part is pale brown, friable loam. The underlying material is light gray, calcareous loam and very fine sandy loam. At a depth of 34 inches is white, weakly cemented, limy sandstone. Small fragments of sandstone are scattered throughout the profile. In some areas the surface layer is very fine sandy loam. In some places it is less than 4 inches thick, mainly because of erosion. In places the subsoil is very fine sandy loam. In a few places the underlying material is loamy fine sand or fine sandy loam. In some areas the soil is very gently sloping.

Typically, the Canyon soils have a surface layer of grayish brown, friable, calcareous very fine sandy loam about 6 inches thick. The next layer is light brownish gray, friable, calcareous very fine sandy loam about 4 inches thick. The underlying material is white, calcareous very fine sandy loam. At a depth of 18 inches is white, weakly cemented sandstone. Small fragments of sandstone are scattered throughout the profile. In some places the surface layer is fine sandy loam. Erosion has caused light-colored underlying material to be exposed at the surface in some areas. Also, in a few places the underlying material is fine sandy loam.

Included with this unit in mapping are small areas of Craft, Oglala, and Duroc soils and Rock outcrop. Craft soils are along very narrow bottom lands of drainageways. They are stratified and are at least 60 inches deep to bedrock. Oglala soils, which are on the lower part of side slopes, are 40 to 60 inches deep to bedrock. Duroc soils are lower on the landscape than Rosebud and Canyon soils. They have a surface soil that is over 20 inches thick, and they are no less than 60 inches deep to bedrock. Rock outcrop is on breaks of side slopes and convex knolls. The included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in both the Rosebud and Canyon soils. The available water capacity is moderate in the Rosebud soils and very low in the Canyon soils. Runoff is medium. The water intake rate for irrigation is moderate. The organic matter content in the Rosebud soils is moderate, and natural fertility is high. The Canyon soils have low organic matter content and low natural fertility. Both soils have good tilth, except in areas of the Canyon soils where rock fragments are numerous in the surface layer.

More than one-half the acreage of these soils is farmed. Most of these areas are used for dryland farming; some are irrigated. The remaining areas are mainly in native grass and are used for grazing.

If used for dryland farming, these soils are poorly suited to winter wheat, alfalfa, and introduced grasses. The principal hazard is water erosion. The restricted root zone, low fertility, and low available water capacity in the Canyon soils limit crop production. Conservation tillage practices, such as stubble mulching and eco-fallow, help conserve moisture and prevent serious water erosion and soil blowing. These soils are suited to terraces and grassed waterways, but terraces may be difficult to construct because of the underlying bedrock. Returning crop residue to the soil helps maintain the organic matter content and tilth. Wind stripcropping helps control soil blowing. Summer fallow stores moisture for use during the following growing season.

If irrigated, these soils are poorly suited to potatoes, corn, sugar beets, alfalfa, and introduced grasses. These soils are best suited to sprinkler irrigation. Water erosion is a severe hazard on cultivated fields. A gravity system is generally not suitable on this unit, because land shaping is needed and bedrock is close to the surface. Conservation tillage practices, such as no-till and eco-fallow, which leave crop residue on the surface, help control water erosion and soil blowing. Returning crop residue to the soil increases the rate of water infiltration and maintains the organic matter content and fertility. These soils are somewhat droughty because they have a limited root zone and moderate or very low available water capacity. Timely and adequate applications of water can help overcome these limitations. Use of commercial fertilizers helps to improve fertility. Erosion in wheel track ruts is a problem when irrigating by the center-pivot system. The irrigation system needs to be designed so that the rate at which water is applied does not exceed the moderate intake rate of these soils.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment from grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed in some areas of eroded cropland to help stabilize the soil.

Onsite investigation is needed before windbreaks are planned. The Rosebud soils provide a fair site for planting trees and shrubs in windbreaks, but the Canyon soils are not suitable for windbreak plantings because of their shallowness to bedrock. The main limitations in the Rosebud soils are the restricted rooting depth and the moderate available water capacity. Seedlings generally survive and grow if competing vegetation is controlled. A cover crop or cultivation between the tree rows can control the undesirable vegetation. Careful use of selected herbicides or rototilling also can be used in the tree rows. Drought is a hazard, especially for young trees, and supplemental watering may be needed.

Onsite investigation is needed before building sites are planned. Septic tank absorption fields generally function in areas of the Rosebud soils if the absorption field is larger than normal. The Canyon soils are generally not suited to use as absorption fields. Sewage lagoons can be constructed in areas of the Rosebud soils if, after excavation of the bedrock, the bottom of the lagoon is sealed to prevent seepage. The soft bedrock beneath both soils needs to be excavated for construction of dwellings with basements or for buildings that have deep foundations. In areas of the Rosebud soils, damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The soft bedrock needs to be excavated in areas of both the Rosebud and Canyon soils if these soils are used as sites for roads.

These soils are assigned to capability units IVe-1, dryland, and IVe-7, irrigated. Rosebud soils are in the Silty range site, and Canyon soils are in the Shallow Limy range site. Rosebud soils are in windbreak suitability group 6R, and Canyon soils are in windbreak suitability group 10.

RsF—Rosebud-Canyon complex, 9 to 30 percent slopes. This map unit consists of moderately deep and shallow, moderately steep and steep, well drained soils. These soils are on ridgetops and side slopes along drainageways of the uplands. These areas are generally dissected by small drainageways. Many areas of this complex are long and narrow and range from 5 to about 500 acres. This unit ranges from 40 to 55 percent moderately deep Rosebud soils and from 30 to 45 percent shallow Canyon soils. Rosebud soils are on the lower part of side slopes, and the Canyon soils are on convex ridgetops and the upper part of side slopes. The areas of the Rosebud soils and the areas of the Canyon soils are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Rosebud soils have a surface layer of grayish brown, friable loam about 7 inches thick. The subsoil is about 13 inches thick. The upper part is brown, friable clay loam, and the lower part is light gray, friable, calcareous loam. The underlying material is light gray, calcareous very fine sandy loam. At a depth of about 37 inches is white, weakly cemented, limy sandstone. Small fragments of soft limestone are scattered in all horizons above the bedrock. In some areas the surface layer is less than 4 inches thick because of erosion. Also, in places the surface layer is very fine sandy loam. The underlying material in a few areas is fine sandy loam. Also, in some areas the subsoil is very fine sandy loam.

Typically, the Canyon soils have a surface layer of dark grayish brown, very friable, calcareous very fine sandy loam about 3 inches thick. The next layer is

grayish brown, friable, calcareous very fine sandy loam about 3 inches thick. The underlying material is light gray, calcareous very fine sandy loam. At a depth of about 12 inches is white, weakly cemented, limy sandstone. In some areas the light-colored underlying material is at the surface because of erosion. Also, in a few places the underlying material is sandy loam.

Included with this unit in mapping are small areas of Craft, Oglala, Duroc, and Norrest soils and outcrops of sandstone bedrock. Craft soils are stratified and on narrow bottom lands along drainageways. Oglala soils are 40 to 60 inches deep to sandstone and are on the lower part of side slopes. Duroc soils have a surface soil over 20 inches thick, are 60 inches deep or deeper to bedrock, and are lower on the landscape than the Rosebud and Canyon soils. Norrest soils have less fine sand in the subsoil than the Rosebud soils and are moderately deep over clayey siltstone. Rock outcrop is on breaks and ridgetops. These inclusions make up about 10 to 15 percent of the unit.

Permeability of the Rosebud and Canyon soils is moderate. The available water capacity is moderate in the Rosebud soils and very low in the Canyon soils. Runoff is rapid on both soils. The organic matter content in the Rosebud soils is moderate, and natural fertility is high. The Canyon soils have low organic matter content and natural fertility.

Most of the acreage of these soils is in native grass and is used for grazing. A few small areas are used for dryland farming because they are in fields dominated by soils suitable for that use.

These soils are not suited to cultivated crops because of the steepness of slope and excessive soil erosion.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective plant cover and causes deterioration of the native plants. Overgrazing also can result in severe soil loss by water erosion. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils generally are not suited to trees and shrubs in windbreaks because of the excessive slope and nearness of bedrock to the surface.

These soils generally are not suitable for use as septic tank absorption fields because of the excessive slope and because of the shallowness to bedrock in Canyon soils. The soft bedrock in both the Rosebud and Canyon soils needs to be excavated for construction of dwellings with basements or for buildings that have deep foundations. In both soils, dwellings and buildings need to be properly designed to complement the slope or the soil needs to be graded. The soft bedrock needs to be excavated in both the Rosebud and Canyon soils if roads and streets are constructed. Cuts and fills are also needed to provide a suitable grade for roads.

These soils are assigned to capability unit VIe-1, dryland, and to the windbreak suitability group 10. The Rosebud soils are in the Silty range site and the Canyon soils are in the Shallow Limy range site.

SbB—Sarben-Busher loamy very fine sands, 0 to 3 percent slopes. This map unit consists of deep, well drained, nearly level and very gently sloping soils on uplands. Areas of this complex range from 5 to about 1,000 acres. The unit ranges from 45 to 60 percent Sarben soil and from 25 to 35 percent Busher soil. The Sarben soil is on the slightly convex, higher part of the landscape, and the Busher soil is on the side slopes and lower part of the landscape. The areas of the Sarben soil and the areas of the Busher soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Sarben soil has a surface layer of grayish brown and dark grayish brown, very friable loamy very fine sand about 6 inches thick. The next layer is brown, very friable loamy very fine sand about 9 inches thick. The upper part of the underlying material is pale brown loamy very fine sand, and the lower part to a depth of 60 inches or more is light gray, calcareous loamy very fine sand. In some places the soil is very fine sandy loam throughout the profile. Also, in some areas the surface layer is darker and thicker. In a few places free carbonates are in the upper 10 inches.

Typically, the Busher soil has a surface layer of grayish brown, very friable loamy very fine sand about 3 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 15 inches thick. The underlying material is light brownish gray loamy very fine sand that is calcareous in the lower part. Below a depth of 40 inches is white, weakly cemented, limy sandstone. In some areas the soil is very fine sandy loam throughout the profile.

Included with these soils in mapping are small areas of Tassel, Valent, and Vetal soils. Tassel soils are 6 to 20 inches deep to sandstone and are higher on the landscape than the Sarben and Busher soils. Valent soils are sandy, are 60 inches deep or deeper to bedrock, and are on slighty higher parts of the landscape. Vetal soils have a surface soil that is over 20 inches thick, are 60 inches deep or deeper to bedrock, and are in the low areas on the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Sarben and Busher soils is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is low in the Sarben soil and moderately low in the Busher soil. Natural fertility is medium in both soils. These soils are easily tilled throughout a wide range in moisture content.

Nearly all of the acreage of these soils is in native grass. The remaining areas are used mainly for irrigated crops.

If used for dryland farming, these soils are poorly suited to winter wheat, introduced grasses, and alfalfa. Soil blowing is a serious hazard where the surface is not adequately protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, help control soil blowing and conserve soil moisture. Use of the crop residue and feedlot manure helps maintain and improve the organic matter content, fertility, and soil tilth. Wind stripcropping helps control soil blowing. Summer fallow can be used to store moisture for use during the following growing season.

If irrigated, these soils are suited to corn, potatoes, field beans, small grains, sugar beets, alfalfa, and introduced grasses. Soil blowing is the principal hazard. Conservation tillage practices, such as eco-fallow and no-till, leave crop residue on the surface and thereby help control soil blowing and conserve soil moisture. The crop residue also improves the organic matter content and fertility and increases infiltration of water. A sprinkler system is best suited to these soils because the soils absorb moisture readily and because land shaping is not necessary. Gravity systems are also suitable if the land is bench leveled to a proper grade so that water movement and intake rate are uniform. If an excessive amount of irrigation water is applied, the nutrients can be leached to a depth below the root zone. In some areas contouring can be used in combination with terracing, if sufficient crop residue is maintained on the surface to protect the soil from blowing. These soils are low in nitrogen and respond well to fertilizers.

The use of these soils for rangeland is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing and in the creation of small blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

These soils provide a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Soil blowing is the principal hazard, particularly to young trees. This can be controlled by maintaining strips of sod or cover crops between the tree rows. Supplemental watering may be needed for the trees during periods of insufficient rainfall. Seedlings generally survive and grow if the site has been properly prepared. Competing vegetation in the row can be controlled by rototilling, hoeing by hand, or careful use of selected herbicides.

If the Busher soil is used as septic tank absorption fields, mounding with several feet of suitable fill material is needed to increase the filtering capacity. The Sarben soil is suited to use as septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage in both soils. These soils are generally suited to use as sites for dwellings and for roads and streets.

These soils are assigned to capability units IVe-3, dryland, and IIIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

SbD—Sarben-Busher loamy very fine sands, 3 to 9 percent slopes. This map unit consists of deep, well drained, gently and strongly sloping soils on uplands. Areas of this complex range from 5 to about 600 acres. The unit ranges from 45 to 60 percent Sarben soil and from 25 to 35 percent Busher soil. The Sarben soil is on ridgetops and the lower part of side slopes. The Busher soil is generally on the upper part of side slopes and on short breaks. The areas of the Sarben soil and the areas of the Busher soil are so intermingled or so small that they could not be shown separately at the scale selected for mapping.

Typically, the Sarben soil has a surface layer of grayish brown, very friable loamy very fine sand about 3 inches thick. The next layer is grayish brown, very friable loamy very fine sand about 9 inches thick. The upper part of the underlying material is light brownish gray loamy very fine sand. The lower part to a depth of 60 inches or more is light gray, calcareous very fine sandy loam and loamy very fine sand. In some areas this soil is very fine sandy loam throughout the profile. Also, in some places the surface layer is darker and thicker than typical.

Typically, the Busher soil has a surface layer of grayish brown, very friable loamy very fine sand about 3 inches thick. The subsoil is grayish brown, very friable loamy very fine sand about 11 inches thick. The underlying material is light gray, calcareous loamy very fine sand. At a depth of about 42 inches is light gray, weakly cemented, limy sandstone. In some areas this soil is very fine sandy loam. In places the underlying material is very fine sand.

Included with these soils in mapping are small areas of Tassel and Valent soils. Tassel soils are 8 to 20 inches deep to soft sandstone and are on the higher part of side slopes and breaks along drainageways. Valent soils are sandy and on slightly higher parts of the landscape than the Sarben and Busher soils. The included soils make up about 10 to 15 percent of the unit.

Permeability of the Sarben and Busher soils is moderately rapid, and the available water capacity is moderate. Runoff is slow in both soils. The water intake rate for irrigation is moderately high. The organic matter content is low in the Sarben soil and moderately low in the Busher soil. Natural fertility is medium. These soils are easily tilled throughout a wide range in moisture content.

Nearly all the acreage of these soils is in native grass and is used for grazing. A few areas are in irrigated crops.

Under dryland farming, these soils are poorly suited to wheat, grasses, and legumes. Soil blowing and water erosion are hazards. Such practices as summer fallow and stubble mulching are used to build up and conserve moisture in the soil and to reduce the hazards of soil blowing and water erosion.

If irrigated, these soils are poorly suited to corn, potatoes, sugar beets, field beans, alfalfa, and introduced grasses. Soil blowing is a serious hazard if the surface is not protected by crops or crop residue. Conservation tillage practices, such as stubble mulching and eco-fallow, leave crop residue on the surface to help control soil blowing and to conserve soil moisture. The use of crop residue and feedlot manure improves the organic matter content and fertility and also increases infiltration of water. A sprinkler system is generally the best for these soils because of the slope and the moderately high intake rate and because little or no land shaping is needed. If the center-pivot type of sprinkler system is used, erosion in wheel track ruts can be a problem when irrigating. The addition of excessive amounts of irrigation water can cause loss of nutrients by leaching. Careful management of the irrigation water is needed. These soils are low in nitrogen, and the crops respond well to fertilizer.

The use of these soils for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing and in the creation of small blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed in some areas to stabilize eroded cropland.

These soils generally provide good sites for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought in summer and soil blowing are the main hazards. Supplemental watering may be needed, especially for seedlings and young trees. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Competing vegetation in the rows can be controlled by timely cultivation with a rototiller, by hand hoeing, or by careful use of selected herbicides.

The use of the Busher soil for septic tank absorption fields is limited by depth to bedrock. This limitation can generally be overcome by increasing the size of the absorption field. The Sarben soil is suited to use as septic tank absorption fields, but in places land shaping may be necessary for its proper operation. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. These soils are generally suited to use for dwellings, but in places the soil may need to be graded. These soils are generally suited to use for roads and streets, but in places cuts and fills are needed to provide a suitable grade.

These soils are assigned to capability units IVe-3, dryland, and IVe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

StB—Satanta fine sandy loam, 0 to 3 percent slopes. This soil is deep, nearly level and very gently sloping, and well drained. It is on slightly convex ridgetops and broad divides of the uplands and on a few stream terraces. Areas range from 5 to about 500 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is 24 inches thick. The upper part is grayish brown, very friable fine sandy loam; the middle part is grayish brown, friable loam; and the lower part is pale brown, friable, calcareous loam. The underlying material to a depth of 60 inches or more is very pale brown, calcareous loam and very fine sandy loam. In some areas the dark material making up the surface layer and upper part of subsoil is more than 20 inches thick. Also, in places the surface layer is loamy fine sand or very fine sandy loam. In some areas the lower part of the suboil is clay loam.

Included with this soil in mapping are small areas of Busher, Creighton, Jayem, and Keith soils. Busher soils have more sand in the subsoil than the Satanta soil and are 40 to 60 inches deep to soft sandstone. Creighton and Jayem soils have more sand and less clay in the subsoil. Jayem soils are on a slightly higher part of the landscape. Keith soils have more clay and less sand in the subsoil. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Satanta soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. Tilth is good, and the soil can be tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is farmed. Some of this acreage is irrigated, but most of it is used for dryland farming. The remaining areas are mainly in native grass and are used for grazing.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Crop selection and growth may be limited by a low amount of summer rainfall. Soil blowing is a serious hazard on soil surfaces that are unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, reduce soil blowing and conserve needed soil moisture. The crop residue also helps maintain the organic matter content, soil tilth, and fertility. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, small grains, field beans, alfalfa, potatoes, and introduced grasses. This soil is suited to both the sprinkler and gravity types of irrigation systems. Soil blowing is the most serious hazard. Conservation tillage practices, such as no-till and eco-fallow, leave crop residue on the surface and thereby help control soil blowing and conserve soil moisture. Crop residue and feedlot manure help maintain the fertility, the organic matter content, and the tilth of the soil and also improve infiltration of water. Some land leveling is needed for satisfactory operation of the gravity irrigation system. Bench leveling provides a uniform grade for the even distribution of water. Contouring can be used in combination with terracing.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. The growth and survival rates of adapted species are fair. Drought and soil blowing are the main hazards for seedlings and young trees. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Supplemental water may be needed for young trees. Seedlings generally survive and grow if the site has been properly prepared and if competing vegetation is controlled. This can be done either by cultivation between the tree rows, by rototilling, or by treatment with an appropriate herbicide.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings and small commercial buildings. Sewage lagoons need to be lined or sealed to prevent seepage. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-3, dryland, and IIe-5, irrigated, and to the Sandy range site and windbreak suitability group 5.

StC—Satanta fine sandy loam, 3 to 6 percent slopes. This soil is deep, gently sloping, and well drained. It is on convex knolls, on side slopes of the uplands, and in a few places on stream terraces. Areas range from 5 to about 100 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is friable and about 19 inches thick. The upper part is grayish brown fine sandy loam, and the lower part is pale brown loam. The underlying material to a depth of 60 inches or more is light gray, calcareous loam and fine sandy loam. In some areas the dark material making up the surface layer is more than 20 inches thick. Also, in places the plowed layer is loamy fine sand. In some areas the lower part of the subsoil is clay loam. In some places the lower part of the underlying material is very fine sandy loam or loamy fine sand.

Included with this soil in mapping are small areas of Busher, Creighton, Jayem, Keith, and Manter soils. Busher soils are 40 to 60 inches deep to soft sandstone and have more sand in the control section than the Satanta soil. Keith soils have more clay and less sand in the subsoil and are lower on the landscape. Creighton, Jayem, and Manter soils have more sand and less clay in the subsoil and generally are on a slightly higher position on the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Satanta soil is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. Tilth is good. This soil can be tilled throughout a fairly wide range in moisture content.

Most of the acreage of this soil is farmed. Most of this acreage is dryfarmed; some is irrigated. The remaining areas are in native grass and are used for grazing.

If used for dryland farming, this soil is suited to small grains, introduced grasses, and alfalfa. Crop selection and growth are limited by the lack of summer rainfall in some years. Soil blowing is a serious hazard on soil surfaces that are unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, reduce soil blowing and conserve needed moisture. The crop residue helps maintain the organic matter content, tilth, and fertility. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, sugar beets, field beans, alfalfa, potatoes, and introduced grasses. This soil is well suited to a sprinkler irrigation system because no land shaping is needed. Soil blowing is the most serious hazard. Conservation tillage practices, which leave crop residue on the surface, help control soil blowing. The use of crop residue and feedlot manure helps maintain soil fertility, the organic matter content, and tilth and also increases infiltration of water. Irrigation systems need to be designed so that the rate at which water is applied does not exceed the moderate water intake rate of the soil. This soil can be bench leveled to provide a uniform slope. Row crops can be planted on the contour if terracing is practiced and if adequate amounts of crop residue are kept on the surface.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause

deterioration of the native plants. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought in summer and soil blowing are the main hazards. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Supplemental watering can supply needed moisture during periods of insufficient rainfall. Seedlings generally survive and grow if the site has been properly prepared and the competing vegetation in the tree row is controlled. Undesirable vegetation in the tree row can be controlled by hand hoeing, rototilling, or use of appropriate herbicides.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings. Sewage lagoons need to be lined or sealed to prevent seepage, and some grading is required to modify the slope and shape the lagoon. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-3, dryland, and IIIe-5, irrigated, and to the Sandy range site and windbreak suitability group 5.

StD—Satanta fine sandy loam, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil is on side slopes and ridges of the uplands and on a few stream terraces. Areas range from 5 to about 50 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 8 inches thick. The subsoil is about 21 inches thick. It is dark grayish brown, very friable fine sandy loam in the upper part; grayish brown, friable clay loam in the middle part; and light gray, friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In a few areas the surface layer is very fine sandy loam. Also, in places the lower part of the underlying material is fine sandy loam or loamy fine sand.

Included with this soil in mapping are small areas of Creighton, Jayem, and Manter soils. The Creighton, Jayem, and Manter soils have more sand and less silt and clay in the subsoil than the Satanta soil. Creighton soils are on the lower parts of the landscape. The included soils make up about 10 to 15 percent of the unit.

Permeability of this Satanta soil is moderate, and the available water capacity is high. Runoff is medium. The water intake rate for irrigation is moderate. The organic matter content is moderately low, and natural fertility is high. Tilth is good, and the soil can be tilled throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Nearly all of these areas are used for dryland farming; a few small areas are irrigated. The remaining areas are mainly in native grass.

If used for dryland farming, this soil is poorly suited to small grains, introduced grasses, and alfalfa. Soil blowing and water erosion are the principal hazards. Conservation tillage practices, such as no-till and stubble mulching, help prevent both soil blowing and water erosion. The use of cover crops is also helpful. The crop residue also helps maintain the organic matter content and fertility. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is poorly suited to alfalfa and introduced grasses. Conservation tillage practices, such as eco-fallow and no-till, keep crop residue on the surface and help control soil blowing and water erosion.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing and haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. Soil blowing is the principal hazard. The use of cover crops or strips of sod between the tree rows helps prevent damage from soil blowing. Competing weeds and grasses in the row can be controlled by rototilling, hoeing by hand, or careful use of selected herbicides. Because rainfall is limited, supplemental watering may be needed when establishing seedlings and young trees.

This soil is generally suited to use as septic tank absorption fields, but in places some grading may be necessary for proper operation of the absorption field. If sewage lagoons are constructed, extensive grading is required to modify the slope and shape the lagoon. Also, lagoons need to be lined or sealed to prevent seepage. If dwellings are constructed on this soil, they should be properly designed to complement the slope or the site should be graded. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. Cuts and fills are generally needed to provide a suitable grade for roads.

This soil is assigned to capability units IVe-3, dryland, and IVe-5, irrigated, and to the Sandy range site and windbreak suitability group 5.

Su—Scott Variant loam, 0 to 1 percent slopes. This soil is deep, nearly level, and very poorly drained. It is in depressions of the uplands and on stream terraces. It is occasionally ponded. Areas are roughly circular and range from 5 to 200 acres.

Typically, the surface layer is gray, friable loam about 6 inches thick. The subsurface layer is light gray, friable loam about 3 inches thick. The subsoil is about 13 inches thick. It is dark gray, very firm clay in the upper part and light brownish gray, firm, calcareous silty clay loam in the lower part. The underlying material is light gray, calcareous silt loam. At a depth of about 41 inches is light gray, weakly cemented, limy sandstone. In some places the surface layer is silt loam. Also, in a few places the soft sandstone or siltstone is not above a depth of 5 feet. In some areas the grayish subsurface layer has been destroyed by cultivation. In a few places the underlying material is clay loam.

Included with this soil in mapping are small areas of Alliance and Duroc soils. Both soils are well drained, have less clay in the subsoil, and are higher on the landscape than the Scott Variant soil. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Scott Variant soil is very slow, and the available water capacity is high. This soil has a perched seasonal high water table that ranges from 1 foot above the surface to 1 foot below. The organic matter content is moderately low, and natural fertility is medium. Tilth is generally good.

Most of the acreage of this soil is farmed. Most cultivated areas are used for dryland farming; a few are irrigated. The remaining areas are mainly in native grass.

If used for dryland farming, this soil is poorly suited to winter wheat, introduced grasses, and alfalfa. Ponding of water is the principal hazard. Terraces and diversions on nearby higher lying soils reduce the run-in water and subsequent crop damage. Conservation tillage practices, such as stubble mulching, leave crop residue on the surface and help to control soil blowing during periods when the soil is not ponded. The crop residue helps maintain the organic matter content, fertility, and tilth of the soil and also increases infiltration of water.

This soil is not suited to irrigation because of occasional ponding and lack of adequate outlets in most areas.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock and deposition of silt reduce the protective plant cover and cause deterioration of the native plants. The range can be maintained or improved by proper grazing use and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a poor site for trees or shrubs in windbreaks because excess water ponds on the surface. In some places the ponding can be controlled and windbreaks can be planted.

This soil is generally not suited to use as septic tank absorption fields or as a site for buildings because of ponding. A suitable alternate site is needed. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the ponding level. Constructing roads on suitable, well compacted fill material above the ponding level and providing adequate side ditches and culverts help protect roads from damage by ponding. Also, damage to roads and streets by frost action can by reduced by providing good surface drainage and by using a gravel moisture barrier in the subgrade.

This soil is assigned to capability unit IVw-2, dryland, and to the Clayey Overflow range site and windbreak suitability group 10.

TaF—Tassel loamy very fine sand, 3 to 30 percent slopes. This soil is shallow, gently sloping to steep, and well drained. It is on narrow ridgetops and uneven side slopes that border drainageways of the uplands. Areas range from 5 to about 400 acres.

Typically, the surface layer is grayish brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material is light gray, calcareous loamy very fine sand with many small sandstone rock fragments. At a depth of 18 inches is white, weakly cemented, limy sandstone. In some areas the surface layer and underlying material are very fine sand or loamy fine sand. Also, in a few places the underlying material is very fine sandy loam or fine sandy loam. In a few areas the depth to sandstone is more than 20 inches.

Included with this soil in mapping are small areas of Busher, Sarben, and Valent soils. Busher soils have a thicker and darker surface layer, are 40 to 60 inches deep to bedrock, and are on a lower part of the landscape than the Tassel soil. Valent soils are sandy. Sarben soils are 60 inches deep or deeper to bedrock and are below the Tassel soils. Also included are small areas of Rock outcrop. These inclusions make up about 10 to 15 percent of the unit.

Permeability of this Tassel soil is moderately rapid, and the available water capacity is very low. Runoff is medium or rapid. The organic matter content and natural fertility are low. Development of plant roots is restricted by sandstone bedrock.

All areas of this soil are in native grass and are used for grazing.

This soil is not suited to farming, either dryland or irrigated, because of the shallowness to bedrock and the slope.

The use of this soil for rangeland is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the productive plant cover and causes deterioration of the native grasses. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation

system under which no range unit is grazed at the same time in successive years.

This soil generally provides a poor site for trees or shrubs in windbreaks because of the shallowness to bedrock and the slope.

This soil is generally not suitable for septic tank absorption fields and sewage lagoons because of the shallowness to bedrock and the slope. A suitable alternate site is needed. This soil is generally not suitable for building sites. Excessive slope is a limitation for building site development. The soft bedrock needs to be excavated for roads and streets, and cuts and fills are generally needed to provide a suitable grade.

This soil is assigned to capability unit VIs-4, dryland, and to the Shallow Limy range site and windbreak suitability group 10.

VaD—Valent fine sand, 3 to 9 percent slopes. This soil is deep, gently and strongly sloping, and excessively drained. It is on ridges, knolls, and low hummocks of the uplands. The soil material was deposited by wind. Areas range from 5 to 1,000 acres.

Typically, the surface layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is brown fine sand. In places the surface layer is loamy fine sand or very fine sand. Also, in places the dark material making up the surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Ipage and Sarben soils. Sarben soils have less fine sand, have generally more silt, and are on a lower part of the landscape than the Valent soil. Ipage soils are moderately well drained, are mottled above a depth of 40 inches, and are in the lower part of concave areas. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Valent soil is rapid. The available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content and natural fertility are low. Tilth is only fair because the soil is loose.

Nearly all of the acreage of this soil is in native grass and is used for grazing or hayland. A few areas are used for irrigated crops.

This soil is not suited to dryland farming because of the coarse texture, slope, and low organic matter content.

If irrigated, this soil is poorly suited to alfalfa, introduced grasses, and corn. This soil is suited to a sprinkler irrigation system, but it is not suited to a gravity system. Soil blowing is the principal hazard. Conservation tillage practices, which maintain all or part of the crop residue on the surface, help to control soil blowing. This soil is droughty because of the low available water capacity. Applications of irrigation water need to be frequent and light. Plant nutrients, such as nitrogen and phosphorus, need to be added. The crop residue and applications of feedlot manure also help improve the organic matter content and fertility. Application of excessive amounts of water results in leaching of plant nutrients below the rooting depth.

This soil is suited to rangeland use, which is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing and in the creation of blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize some eroded areas.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought and soil blowing are the main hazards. Supplemental watering can provide moisture during periods of insufficient rainfall. The trees should be planted in a shallow furrow with as little disturbance of the soil as possible. Competing vegetation and soil blowing can be controlled by the use of sod between the rows and also within the rows. The sod can be mowed. Areas near the trees can be hoed by hand or treated with an appropriate herbicide.

This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in pollution of the ground water. If sewage lagoons are constructed, grading is required to modify the slope and shape the lagoon. Lagoons also need to be lined or sealed to prevent seepage. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. This soil is generally suited to use as a site for dwellings and roads and streets.

This soil is assigned to capability units VIe-5, dryland, and IVe-12, irrigated, and to the Sands range site and windbreak suitability group 7.

VaE—Valent fine sand, 9 to 17 percent slopes. This soil is deep, moderately steep, and excessively drained. It is on side slopes of hummocks and dunes of the uplands. The soil material was deposited by wind. Areas range from 5 to 400 acres.

Typically, the surface layer is grayish brown, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In a few places the surface layer is loamy fine sand or loamy sand. Also, in places the surface layer is more than 10 inches thick. In a few places free carbonates are as high in the profile as 15 inches from the surface.

Included with this soil in mapping are small areas of Sarben and Vetal soils. Sarben soils have less sand, have generally more silt, and are lower on the landscape than the Valent soil. Vetal soils have a darker, thicker surface soil, have less sand and more silt, and are lower

on the landscape. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Valent soil is rapid. The available water capacity is low. Runoff is slow. The organic matter content and natural fertility are low.

Nearly all the acreage of this soil is in native grass. It is used mainly for grazing, but some areas are mowed for hay.

This soil is not suited to farming, either dryland or irrigated, because of the sandy texture, slope, and very severe erosion hazard.

This soil is suited to rangeland use, which is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing and in the creation of blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize severely eroded areas.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Sod can be maintained between the rows and also within the rows to control soil blowing. The sod between the rows can be mowed. Areas near the trees can be hoed by hand or treated with an appropriate herbicide. Trees need to be planted in a shallow furrow with as little disturbance of the soil as possible. Drought is a hazard, and supplemental watering may be needed.

This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in pollution of the ground water. If sewage lagoons are constructed, extensive grading is required to modify the slope and shape the lagoon. Lagoons also need to be lined or sealed to prevent seepage. If dwellings are constructed on this soil, they should be designed to complement the slope or the site should be graded. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Cuts and fills are generally needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIe-5, dryland, and to the Sands range site and windbreak suitability group 7.

VdB—Valent loamy fine sand, 0 to 3 percent slopes. This soil is deep, nearly level and very gently sloping, and excessively drained. It is on uplands where the soil material was deposited by wind. Areas range from 5 to about 500 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The underlying material is brown loamy fine sand in the upper part and light brownish gray fine sand to a depth of 60 inches or more in the lower part. In some places the surface layer is very fine sand or fine sand. Also, in a few areas the upper part of the underlying material is very fine sandy loam or fine sandy loam. In some places the surface layer is more than 10 inches thick. Also, in places free carbonates are above a depth of 15 inches.

Included with this soil in mapping are small areas of the finer textured Sarben, Jayem, and Busher soils on slightly lower parts of the landscape than the Valent soil. The included soils make up about 5 to 15 percent of this unit.

Permeability of this Valent soil is rapid. The available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content and natural fertility are low. This soil is easily tilled.

Most of the acreage of this soil is in native grass and is used for grazing or hayland. A few areas are farmed, and most of these are irrigated.

This soil is not suited to dryland farming because of inadequate rainfall, sandy texture, and the very severe erosion hazard.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. Soil blowing is the principal hazard. This soil is suited to a sprinkler irrigation system. Gravity systems are not suitable. Conservation tillage practices, such as no-till and eco-fallow, maintain all or most of the crop residue on the surface and thereby help to control soil blowing and conserve soil moisture. Efficient management of irrigation water is important on this soil because excessive amounts of water can leach the plant nutrients to depths below the root zone. Application of water needs to be frequent and light because of the low available water capacity. Use of crop residue improves the organic matter content and fertility. This soil responds well to applications of commercial fertilizer, particularly nitrogen.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe soil loss by soil blowing in the creation of small blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize some eroded areas.

This soil provides a good site for trees and shrubs in windbreaks. The survival and growth rates of adapted species are fair. Competing vegetation and soil blowing can be controlled by maintaining strips of sod between the tree rows. Trees should be planted in shallow furrows with as little disturbance of the soil as possible. In areas near the trees, hand hoeing or an appropriate herbicide can be used to control weeds and grasses. Lack of sufficient rainfall is also a problem, especially for

seedlings and young trees. Irrigation can provide supplemental water during periods of insufficient rainfall.

This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in pollution of the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. This soil is generally suited to use as a site for dwellings and roads and streets.

This soil is assigned to capability units VIe-5, dryland, and IVe-11, irrigated, and to the Sandy range site and windbreak suitability group 7.

VdD—Valent loamy fine sand, 3 to 9 percent slopes. This soil is deep, gently and strongly sloping, and excessively drained. It is on uplands where the soil material was deposited by wind. Areas range from 10 to 2,000 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In some places the surface layer is very fine sand or fine sand. In a few places the upper part of the underlying material is very fine sandy loam or fine sandy loam. Also, in some areas free carbonates are above a depth of 15 inches.

Included with this soil in mapping are small areas of Busher and Sarben soils. Busher soils have a thicker surface layer, are finer in texture, are 40 to 60 inches deep to bedrock, and are on lower parts of the landscape than the Valent soil. Sarben soils are finer in texture and are on lower parts of the landscape. Also included are small areas of Rock outcrop, generally on high parts of the landscape. These inclusions make up about 5 to 15 percent of the unit.

Permeability of this Valent soil is rapid. The available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content and natural fertility are low. This soil is easily tilled throughout a wide range in moisture content.

Nearly all of the acreage of this soil is in native grass and is used for grazing or mowed for hay. A few areas are farmed and are irrigated by sprinkler systems.

This soil is generally not suited to dryland farming because of the slope, sandy texture, and very severe soil erosion hazard.

If irrigated, this soil is poorly suited to alfalfa, corn, and introduced grasses. Soil blowing is a serious hazard on this soil. Conservation tillage practices, such as stubble mulching and eco-fallow, maintain a large amount of crop residue on the surface and thereby help conserve moisture and prevent soil blowing. Conserving all the available moisture is important because of the low available water capacity. The crop residue and feedlot manure help improve the organic matter content. The application of excessive water can leach nutrients to depths below the root zone. Application of water needs to be light and frequent. Crops respond well to applications of commercial fertilizer.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing and the creation of small blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize eroded areas.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Sod or residue cover can be maintained between the tree rows to control soil blowing. The sod can be mowed. Irrigation can provide supplemental water for seedlings or young trees during times of insufficient rainfall. The trees should be planted in shallow furrows with as little disturbance of the soil as possible. Competing vegetation in the tree row can be controlled by careful use of appropriate herbicides or by hand hoeing.

This soil readily absorbs the effluent from septic tank absorption fields, but it does not adequately filter the effluent. The poor filtering capacity may result in pollution of the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. This soil is generally suited to use as a site for dwellings and roads and streets.

This soil is assigned to capability units VIe-5, dryland, and IVe-11, irrigated, and to the Sands range site and windbreak suitability group 7.

VdE—Valent loamy fine sand, 9 to 17 percent slopes. This soil is deep, moderately steep, and excessively drained. It is on side slopes and crests of hills in the eolian uplands. Areas range from 10 to 500 acres.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 3 inches thick. The underlying material is brown fine sand in the upper part and pale brown fine sand to a depth of 60 inches or more in the lower part. In some places the surface layer is fine sand or very fine sand. Also, in some areas the underlying material is loamy fine sand in the upper part. In a few areas free carbonates are above a depth of 15 inches.

Included with this soil in mapping are small areas of Busher and Sarben soils. Busher soils are finer in texture, are 40 to 60 inches deep to soft bedrock, and are lower on the landscape than the Valent soil. Sarben

soils are finer in texture, generally have more silt, and are lower on the landscape. Also included are small areas of the shallow Tassel soils on the higher part of side slopes. Included in some areas are small outcrops of rock and gravel and areas with steep slopes. These inclusions make up about 10 to 15 percent of the unit.

Permeability of this Valent soil is rapid. The available water capacity is low. Runoff is slow. The organic matter content and natural fertility are low.

Nearly all of the acreage of this soil is in native grass and is used for grazing. A few areas are mowed for hay.

This soil is not suited to cultivated crops, either dryland or irrigated, because of the excessive slope, sandy texture, and very severe erosion hazard.

This soil is suited to use as rangeland, and this use is effective in controlling both soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing and in the creation of blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize severely eroded areas.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Soil blowing and drought are the principal hazards. Sod can be maintained between the rows and within the rows. Planting the trees in shallow furrows with as little disturbance of the soil as possible can prevent soil blowing, which can cover the seedlings by drifting sand. Supplemental watering can provide needed moisture during times of insufficient rainfall. Areas near the trees can be hoed by hand or treated with an appropriate herbicide.

This soil readily absorbs the effluent from septic tanks, but it does not adequately filter the effluent. The poor filtering capacity may result in pollution of the ground water. If sewage lagoons are constructed, extensive grading is required to modify the slope and shape the lagoon. Also, the lagoon needs to be sealed or lined to prevent seepage. If dwellings are constructed on this soil, they should be designed to complement the slope or the site should be graded. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Cuts and fills are generally needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIe-5, dryland, and to the Sands range site and windbreak suitability group 7.

VnD—Valentine fine sand, 3 to 9 percent slopes. This soil is deep, gently sloping and strongly sloping, and excessively drained. It is on hummocks in the sandhills part of the county. Areas range from 10 to about 500 acres.

Typically, the surface layer is grayish brown, loose fine sand about 5 inches thick. The next layer is grayish brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is brown fine sand. In a few small areas the soil is moderately steep. In some areas the surface layer is darker and is thicker than 10 inches.

Included with this soil in mapping are small areas of Ipage soils. Ipage soils are moderately well drained, are mottled above a depth of 40 inches, and are on lower parts of the landscape than the Valentine soil. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Valentine soil is rapid. The available water capacity is low. Runoff is slow. The water intake rate for irrigation is very high. The organic matter content and natural fertility are low.

Nearly all the acreage of this soil is in native grass and is used mainly for grazing. The few remaining areas are in irrigated crops.

This soil is generally not suited to dryland farming because of the sandy texture and severe hazard of erosion.

If irrigated, this soil is poorly suited to corn, alfalfa, and introduced grasses. Soil blowing is a severe hazard if the surface is not protected. Use of close growing crops, leaving crop residue on the surface, and using a winter cover crop helps prevent soil blowing. Conservation tillage practices, such as no-till and eco-fallow, leave all or most of the crop residue on the surface and help control soil blowing. Use of manure helps improve the organic matter content and fertility. Supplemental application of fertilizers, such as nitrogen and phosphorus, is needed for maximum crop growth. Irrigation water needs to be applied lightly and often because of the low available water capacity. Nutrients can be lost by leaching if excessive amounts of water are applied.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in severe loss by soil blowing and in the creation of blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize some eroded areas.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought and soil blowing are the principal hazards to seedlings and young trees. Trees need to be planted in a shallow furrow with as little disturbance of the soil as possible in order to prevent soil blowing,

which can cover the small trees with drifting sand during high winds. Supplemental water can be applied during periods of insufficient rainfall. Sod needs to be maintained between the rows and also within the row. Areas near the trees can be hoed by hand or treated with an appropriate herbicide.

This soil readily absorbs the effluent from septic tanks, but it does not adequately filter the effluent. Sewage lagoons need to be lined or sealed to prevent seepage. Some grading may be needed to modify the slope and shape the lagoon. The walls and sides of temporary shallow excavations need to be shored to prevent sloughing or caving. This soil is generally suited to use as a site for dwellings and roads and streets.

This soil is assigned to capability units VIe-5, dryland, and IVe-12 irrigated, and to the Sands range site and windbreak suitability group 7.

VnE—Valentine fine sand, 9 to 17 percent slopes. This soil is deep, moderately steep, and excessively drained. It is on the rolling parts of the sandhills. Areas range from 10 to about 1,200 acres.

Typically, the surface layer is grayish brown, loose fine sand about 3 inches thick. The next layer is brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In a few small places the soil is steep. Also, in some areas the surface layer is darker and over 10 inches thick.

Included with this soil in mapping are small areas of Ipage soils. These soils are moderately well drained, are mottled above a depth of 40 inches, and are on lower parts of the landscape than the Valentine soil. The included soils make up about 3 to 5 percent of the unit.

Permeability of this Valentine soil is rapid. The available water capacity is low. Runoff is slow. The organic matter content and natural fertility are low.

This soil is not suited to cultivated crops, either dryland or irrigated, because of the excessive slope, sandy texture, and very severe hazard of erosion.

All the acreage of this soil is in native grass and used mainly for grazing. A few areas are mowed for hay.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in severe loss by soil blowing and the creation of blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years. Range seeding may be needed to stabilize severely eroded areas.

This soil provides a fair site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Drought and soil blowing are the principal hazards to seedlings and young trees. Trees should be planted in a shallow furrow with as little disturbance of the soil as possible in order to prevent soil blowing. During high winds, drifting sand can cover the small trees. Supplemental water may be needed during times of insufficient rainfall. Sod can be maintained between the rows and also within the row to prevent soil blowing. The sod can be mowed. Areas near the trees can be hoed by hand.

This soil readily absorbs the effluent from septic tanks, but it does not adequately filter the effluent. The poor filtering capacity of the soil may result in pollution of the ground water. Sewage lagoons need to be lined or sealed to prevent seepage, and extensive grading is required to modify the slope and shape the lagoons. If dwellings are constructed on this soil, they should be designed to complement the slope or the site should be graded. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Cuts and fills are generally needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIe-5, dryland, and to the Sands range site and windbreak suitability group 7.

VnF—Valentine fine sand, hilly. This soil is deep and excessively drained. It is on the higher parts of the sandhills where high dunes are common. The hilly slopes are commonly short and very steep and range from 17 to 60 percent. Catsteps are common on the steepest part. Areas range from 20 to about 3,500 acres.

Typically, the surface layer is grayish brown, loose fine sand about 2 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In some areas the soil is only moderately steep.

Included with this soil in mapping are small blowout areas that are almost barren of vegetation and are generally on side slopes or on higher parts of the landscape than the Valentine soil. These inclusions make up about 2 to 5 percent of this unit.

Permeability of this Valentine soil is rapid. The available water capacity is low. Runoff is slow or medium, depending primarily on the amount of vegetation that is present. The organic matter content and natural fertility are low.

All of the acreage of this soil is in native grass and is used for grazing.

This soil is not suited to farming, either dryland or irrigated, because of the excessive slope, sandy texture, and very severe erosion hazard.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing by livestock reduces the protective cover of the native grasses. It also can result in severe loss by soil blowing and in the creation of blowouts. The range can be maintained or improved by proper grazing use, timely deferment of grazing, and the use of a rotation

system under which no range unit is grazed at the same time in successive years.

This soil is generally not suited to trees or shrubs in windbreaks. The survival rate is poor. In some places plantings can be made if special procedures, such as site preparation and hand planting, are applied.

This soil generally is not suited to use as septic tank absorption fields because of the steep slopes. A suitable alternate site is needed. If dwellings are constructed on this soil, they should be designed to complement the slope or the site should be graded. The walls or sides of temporary shallow excavations need to be shored to prevent sloughing or caving. Cuts and fills are needed to provide a suitable grade for roads.

This soil is assigned to capability unit VIIe-5, dryland, and to the Choppy Sands range site and windbreak suitability group 10.

VtB—Vetal fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on foot slopes and in the upland swales. Most areas are long and narrow and range from 5 to about 200 acres.

Typically, the surface layer is dark gray, very friable fine sandy loam about 10 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 14 inches thick. The next layer is grayish brown, very friable fine sandy loam about 12 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, calcareous loamy fine sand and contains a few small fragments of sandstone. In some places the surface soil and the layer below that are very fine sandy loam, and in some other areas they are loamy very fine sand. Also, in places the surface soil is less than 20 inches thick. In some areas sandstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Bridget, Duroc, and Satanta soils. Bridget soils have a thinner surface layer, less sand, and free carbonates above a depth of 18 inches and are slightly lower on the landscape than the Vetal soil. Duroc soils have less sand, have more clay, and are generally lower on the landscape. Satanta soils have a thinner surface layer, have more clay and less sand, and are generally higher on the landscape. The included soils make up about 5 to 15 percent of the unit.

Permeability of this Vetal soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is high. Tilth is good. The soil can be tilled throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Most of the cultivated areas are used for dryland farming; a few are irrigated. The remaining areas are mainly in native grass and are used for grazing and haying.

If used for dryland farming, this soil is suited to winter wheat, alfalfa, and introduced grasses. Inadequate summer rainfall commonly limits the selection and growth of cultivated crops. Soil blowing is the principal hazard on surfaces that are unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, keep crop residue on the surface and thereby help to control soil blowing and conserve needed soil moisture. The crop residue also helps maintain the fertility, organic matter content, and tilth of the soil. Wind stripcropping helps control soil blowing. Summer fallow conserves moisture for use during the following growing season.

If irrigated, this soil is suited to corn, field beans, sugar beets, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard if the surface is not protected. A conservation tillage system, such as eco-fallow or no-till, leaves all or part of the crop residue on the surface and thereby helps control soil blowing and conserves soil moisture. This soil is best suited to a sprinkler irrigation system because of its moderately high intake rate and because no land shaping is needed. Some land leveling is needed for the satisfactory operation of a gravity system. Bench leveling provides a suitable grade so that water distribution is uniform. Nutrients can be lost by leaching if excessive amounts of irrigation water are applied. Row crops can be grown on the contour if the soil is terraced and if sufficient crop residue is maintained on the surface to prevent erosion.

This soil is suited to use as rangeland, and this use is very effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native grasses. Overgrazing can result in soil loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Soil blowing and drought are the principal hazards. Seedlings and young trees may need supplemental watering during times of insufficient rainfall. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Cultivation generally needs to be restricted to the tree rows. Competing vegetation in the tree rows can be controlled by hand hoeing, rototilling, or careful use of selected herbicides. Either tillage or chemical methods are effective in preparing a favorable site for plantings.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings. Sewage lagoons need to be lined or sealed to prevent seepage. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning

the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-3, dryland, and IIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

VtC—Vetal fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on foot slopes and in concave areas of the uplands. Most areas are narrow and long and range from 5 to about 75 acres.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 13 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 13 inches thick. The next layer is light brownish gray, very friable fine sandy loam about 12 inches thick. The upper part of the underlying material is pale brown, loamy fine sand, and the lower part to a depth of 60 inches or more is light gray, calcareous loamy fine sand. Many small and medium fragments of sandstone are in the lower part. In some places the surface soil and the layer below that are very fine sandy loam, and in some other areas they are loamy very fine sand. Also, in places the surface soil is less than 20 inches thick. In some areas sandstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Bridget and Valent soils. Bridget soils have a thinner surface layer, have less sand, have free carbonates above a depth of 18 inches, and are generally lower on the landscape than the Vetal soil. Valent soils are coarser in texture, have a thinner surface layer, and are slightly higher on the landscape. The included soils make up about 5 to 10 percent of the unit.

Permeability of this Vetal soil is moderately rapid, and the available water capacity is moderate. Runoff is slow. The water intake rate for irrigation is moderately high. The organic matter content is moderately low, and natural fertility is high. Tilth is good. This soil can be tilled throughout a wide range in moisture content.

Most of the acreage of this soil is farmed. Most cultivated areas are used for dryland farming; a few are irrigated. The remaining areas are mainly in native grass and are used for grazing or are mowed for hay.

If used for dryland farming, this soil is suited to winter wheat, introduced grasses, and alfalfa. Inadequate summer rainfall usually limits the selection of cultivated crops that can be successfully grown. Soil blowing is the principal hazard on soil surfaces that are unprotected. Conservation tillage practices, such as stubble mulching and eco-fallow, help keep all or part of the crop residue on the surface and thereby help control soil blowing and conserve needed moisture. The crop residue helps maintain the fertility, organic matter content, and tilth of the soil. Wind stripcropping helps control soil blowing. Summer fallow conserves soil moisture for use during the following growing season.

If irrigated, this soil is suited to corn, field beans, sugar beets, potatoes, alfalfa, and introduced grasses. Soil blowing is the principal hazard if the surface is not protected. Rilling by water can also be a hazard on these slopes. A conservation tillage system, such as stubble mulching or no-till, keeps all or most of the crop residue on the surface and thereby controls soil blowing and water erosion. This soil is best suited to a sprinkler irrigation system because of the moderately high intake rate and because land shaping is not needed. Plant nutrients can be lost by leaching if excessive amounts of irrigation water are applied. This soil responds well to irrigation water and to applications of fertilizer. This soil can be irrigated by a gravity system if it is bench leveled to prevent erosion. Contouring can be used in combination with terracing if crop residue remains on the surface to help control erosion.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing by livestock and untimely haying or improper mowing height reduce the protective plant cover and cause deterioration of the native plants. Overgrazing can result in soil loss by soil blowing. The range can be maintained or improved by proper grazing use, timely deferment of grazing or haying, and the use of a rotation system under which no range unit is grazed at the same time in successive years.

This soil provides a good site for trees and shrubs in windbreaks. Adapted species show fair growth and survival. Soil blowing and drought are the principal hazards. Seedlings and young trees may need supplemental watering during periods of insufficient rainfall. Soil blowing can be controlled by maintaining strips of sod or an annual cover crop between the tree rows. Competing vegetation in the row can be controlled by timely cultivation or by the careful use of appropriate herbicides. Tillage or chemical methods are effective in preparing a favorable site for plantings.

This soil is generally suited to use as septic tank absorption fields and as a site for dwellings. Sewage lagoons need to be lined or sealed to prevent seepage. Damage to roads and streets by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-3, dryland, and IIIe-8, irrigated, and to the Sandy range site and windbreak suitability group 5.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. It is of major importance in providing the nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland is defined as the land best suited to producing food, feed, forage, fiber, and oilseed crops. When it is treated and managed using acceptable farming methods, it has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops. These high yields are produced with minimal expenditure of energy and economic resources, and farming this land results in the least damage to the environment.

Prime farmland may now be in cropland, pasture, or woodland or it may be in other uses, but it is not urban and built-up land or water areas. It must either be used for producing food or fiber or be available for these uses.

Prime farmland usually has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity of the soil is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information on the criteria for prime farmland can be obtained at the local office of the Soil Conservation Service.

About 347,900 acreas, or 51 percent, of Box Butte County meets the soil requirements for prime farmland.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. This loss to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and difficult to cultivate, and usually less productive.

Soil map units that make up prime farmland in Box Butte County are shown in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Soils that have limitations—a high water table, flooding, or inadequate moisture from rainfall—may qualify as prime farmland if these limitations are overcome by such measures as drainage, flood control, or irrigation. In table 5, the measures used to overcome the limitations are shown in parentheses after the map unit name. Onsite evaluation is necessary to see if these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; for windbreaks; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

William E. Reinsch, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to the Nebraska Agriculture Statistics, about 53 percent of the total land in farms in Box Butte County is used as cropland and pasture. The largest acreage is used for dryland winter wheat and fallow. The rest is used mainly for irrigated field beans, corn, and sugar beets. About 24 percent of the cropland is irrigated.

The potential of soils in the county for increased production of food is good. Soils that are in land capability classes I through IV under dryland farming or irrigation are suited to use as cropland.

Management for Dryland Crops

Good management practices for dryland crops are those that reduce runoff and the risk of water erosion and soil blowing, conserve moisture, and improve tilth. Most of the soils are suitable for crops. In many areas, however, erosion is a severe hazard and should be controlled by suitable conservation practices.

Level terraces, contour farming, grassed waterways, and a conservation tillage system, which keeps crop residue on the surface, help to control water erosion. Keeping crop residue on the surface or growing a protective plant cover helps to prevent sealing and crusting of the soil during and after heavy rains. The moisture supply is increased in winter because the stubble catches drifting snow.

Soil blowing is a hazard on nearly all tillable soils, especially during periods when the amount of rainfall is below average. It can be controlled by a conservation tillage system, which leaves crop residue on the surface, and by wind stripcropping. Planting row crops on the more productive soils and planting hay, pasture plants, or close-grown crops, such as small grain and alfalfa, on the steeper, more erodible soils help to control both soil blowing and water erosion. In many places, proper use of the land alone can reduce the hazard of erosion.

In Box Butte County, an insufficient amount of rainfall is the main limitation affecting dryland crops. A cropping system that conserves moisture and controls water

erosion and soil blowing is needed. A cropping system is the sequence of crops grown on a field and the management needed to conserve soil and water. It should preserve tilth and fertility, maintain a protective plant cover, and control weeds as well as insects and disease on soils used for dryland crops. The cropping system selected should be the one best suited to the soil. For example, on Satanta fine sandy loam, 6 to 9 percent slopes, it should include a conservation tillage system that maintains 1,500 pounds per acre of small grain residue on the surface to protect the soil from water erosion and soil blowing. On Keith loam, 0 to 1 percent slopes, however, 1,000 pounds of small grain residue will protect the soil from erosion.

Preparing a seedbed helps to control weeds and to provide a favorable growing medium for plants. If tillage is excessive, however, the granular structure in the surface breaks down and tilth deteriorates. Tillage should be kept at a minimum. Various methods are used to reduce tillage in Box Butte County. Examples of methods that are well suited to all of the commonly grown crops are (1) a fallow system in which weeds are controlled by use of herbicides rather than by tillage; (2) a system in which the soil is tilled with disks or chisels, which keep tillage at a minimum and keep crop residue on the surface; and (3) a stubble mulching system in which crop residue from winter wheat remains on the surface after the soil is tilled. Grass seed can be drilled into a cover of stubble without further seedbed preparation.

Additional nutrients are needed in some of the soils used for dryland crops. The kinds and amounts of fertilizer to be applied should be based on the results of soil tests and on the content of moisture in the soil at the time of application. If the subsoil is dry and the amount of rainfall is low, fertilizer should be applied at a slightly lower rate than that needed when the soil is moist. On all soils used for nonlegume crops, nitrogen fertilizer is beneficial. Phosphorus and zinc are commonly needed on the more eroded soils and in areas that are cut for terraces, diversions, or benches. The amount of fertilizer needed on soils used for dryland crops is smaller than the amount needed on soils used for irrigated crops, because the plant population is lower.

On the soils assigned to capability subclass IIe, such as Keith loam, 1 to 3 percent slopes, the best management includes a cover of crop residue, wind stripcropping, applications of fertilizer or feedlot manure, selection of suitable crop varieties, and a planned crop rotation. On the soils assigned to capability subclass IIIe, such as Keith loam, 3 to 6 percent slopes, the best management includes a cover of crop residue throughout the winter, wind stripcropping, terracing, and a conservation tillage system that leaves, per acre, about 3,000 pounds of corn or sorghum residue or 1,500 pounds of small grain residue on the surface after the crops are planted. If the slope is more than 10 percent, grasses and legumes are needed in the cropping sequence to control water erosion. The conversion of cropland to pasture or hayland is an economic alternative for land in class IV.

Some soils in Box Butte County, such as Scott Variant, are subject to ponding. Unless the ponding can be controlled, the crops selected for planting should be those that can grow in a wet soil.

Some soils are saline or sodic and are unfavorable for many plants that are climatically adapted. Examples of such soils are Las Animas-Lisco very fine sandy loams; Janise loamy fine sand, overblown; Janise loamy fine sand, drained, overblown; Janise loam, drained; and Janise loam. Saline or sodic (alkali) conditions affect the kind and production of crops and forage plants. Drainage by surface ditches or by subsurface drains can improve these soils where adequate outlets are available. Crops and forage plants that have a good degree of salt tolerance can be grown. Barley, sugar beets, and winter wheat are more tolerant than field beans, corn, and potatoes. Forage species such as tall wheatgrass and birdsfoot trefoil are more tolerant than alfalfa or orchardgrass. Applications of feedlot manure and commercial fertilizer, particularly phosphorus, help overcome the low fertility of these soils. Gypsum and sulfur can be applied on a trial basis, but results in the field are commonly disappointing.

Applications of herbicide are effective in controlling weeds. The kind and amount applied, however, should be carefully controlled. The application rate should be determined by the colloidal clay and humus fraction of the soil, which is responsible for most of the chemical activity in the soil. Application of a large amount of herbicide results in crop damage on sandy soils, which have a low content of colloidal clay, and on soils that have a moderately low or low content of organic matter. Applying herbicides according to the kind of soil can lessen the danger of damage to crops.

Management for Irrigated Crops

About 24 percent of the cropland in Box Butte County is irrigated. Corn and dry, edible beans and sugar beets are the principal irrigated crops. A smaller acreage is used for alfalfa hay, wheat, and potatoes. Corn, beans, and sugar beets can be irrigated by the furrow or sprinkler method. For alfalfa, the border, contour ditch, corrugation, or sprinkler method can be used. Wheat is irrigated under sprinkler systems, usually in rotation with beans or corn. The irrigation water is drawn from wells.

The management needed in irrigated areas includes selecting a proper cropping sequence, land leveling to provide a proper grade for the even distribution of irrigation water, using measures that conserve moisture and control water erosion, and ensuring that the rate at which water is applied does not exceed the intake rate of the soil.

The cropping sequence on soils that are well suited to irrigation is dominated by row crops. One that includes different row crops, small grains, and alfalfa or grass helps to control the diseases and insects that are common if the same crop is grown year after year.

A gently sloping soil, such as Keith loam, 3 to 6 percent slopes, is subject to water erosion in areas where it is irrigated by furrows that run downslope. Contour bench leveling or a combination of contour furrows and parallel terraces helps to control water erosion in these areas. In areas where a sprinkler system is used, terracing, contour farming, grassed waterways, and a conservation tillage system, which keeps crop residue on the surface, help to control water erosion. They also conserve water.

If an adequate amount of water is available, sprinklers are most effective on the moderately coarse and coarse textured soils and can be used on the more sloping and nearly level soils. The sprinklers are either the center-pivot type, which revolve around a central point, or are sets of sprinklers installed at various locations in the field. The water can be applied at a rate that does not exceed the intake rate of the soil and thus result in excessive runoff. Because the water can be carefully controlled, sprinklers are effective in helping to establish new pastures on moderately steep soils. In summer, however, much of the water is lost through evaporation. Keeping crop residue on the surface increases the intake rate and decreases the evaporation rate. Wind drift can result in an uneven distribution of water in some areas.

Soil holds only a limited amount of water. The silt loams and loams in Box Butte County, for example, hold about 2 inches of available water per foot of soil depth. Thus, a soil that is 4 feet deep and is planted to a crop that sends its roots to that depth can hold about 8 inches of water available for that crop. Irrigation should begin when about one-half of the available water has been used by the crop. Applying the water at regular intervals helps to keep the soil moist throughout at all times. The interval varies according to the crop and the time of year.

A tailwater recovery pit at the end of a field that is furrow irrigated helps to trap runoff of excess irrigation tailwater. This water can then be pumped to the upper end of the field and used again. These pits increase the efficiency of the irrigation system and conserve the supply of underground water.

All of the soils in Nebraska are assigned to irrigation design groups, which are described in the Nebraska Irrigation Guide (*12*). The Arabic numerals shown in the designations of irrigation capability units at the end of map unit descriptions under the heading "Detailed Soil Map Units" indicate the irrigation design groups to which the soils are assigned.

Assistance in planning and designing an irrigation system is available through the local office of the Soil Conservation Service or the county agricultural agent. Estimates concerning cost of equipment can be obtained from dealers and manufacturers of irrigation equipment.

Managing Pasture and Hayland

Areas that are used for hay or pasture should be managed for maximum production. Use of a rotation system that results in a uniform distribution of grazing is needed. Many forage plants are a good source of minerals, vitamins, protein, and other nutrients. A well managed pasture can provide a balanced ration throughout the growing season. Adding plant nutrients to the soil helps to obtain maximum production. The kinds and amounts of fertilizer needed should be determined by soil tests. If pastures are irrigated, a high level of management is needed.

A mixture of grasses and legumes can be grown in rotation with grain crops on many soils. The grasses and legumes improve tilth, increase orgainic matter content, and help to control erosion. They are ideal as part of a conservation cropping system.

The most commonly grown grasses for irrigated pasture are smooth brome and orchardgrass. Other grasses and legumes that are adapted to irrigation in Box Butte County are intermediate wheatgrass, meadow brome, and creeping foxtail. Legumes that may have a potential for pasture are birdsfoot trefoil and cicer milkvetch. Irrigated pastures in the county can produce 750 to 900 pounds of beef per acre with a high level of management.

Grasses that have potential for production of dryland pasture are crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and western wheatgrass. Smooth brome is well suited to the lower, wetter soils.

Grasses and legumes used for pasture and hayland, both irrigated and dryland, require additional plant nutrients for maximum production. The kinds and amounts of fertilizer needed should be determined by a soil test.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIw-4 or IIIe-3.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

Peter N. Jensen, range conservationist, Soil Conservation Service, helped to prepare this section.

Rangeland amounts to approximately 46 percent of the total agricultural land in Box Butte County. It is largely in the sandy uplands in the western and southern areas of the county. It is also in the broken lands associated with the Niobrara River drainageway. Rangeland is common in the Sarben-Busher, Valent-Dailey, Busher-Valent-Tassel, Norrest-Canyon-Creighton, and Valentine soil associations. These are described under the heading "General Soil Map Units."

The majority of the rangeland is in Sandy, Sands, Shallow Limy, Saline Subirrigated, and Saline Lowland range sites. The remainder is in Silty, Limy Uplands, Subirrigated, Wet Subirrigated, Silty Lowland, Sandy Lowland, Silty Overflow, Clayey Overflow, Shallow to

Gravel, Wet Land, and Choppy Sands range sites. The average size of ranches or livestock farms in Box Butte County is about 4,000 acres.

The raising of livestock, namely cow and calf herds, with calves sold in the fall as feeders, is the largest agricultural industry in the county. The rangeland is generally grazed 8 to 10 months (spring to early winter), and hay is fed to livestock the rest of the year.

Approximately one-half of the rangeland has been depleted or is not producing its potential in kinds and amounts of native plants. This is largely because of overgrazing. Commonly these overgrazed pastures are producing an abundance of low quality plants, grasses, and forbs. The productivity of the range can be increased by such proper range management practices as proper grazing use; deferment or rest; planned grazing systems; and range seeding or brush and weed management, or both.

Some areas of the rangeland are used for production of native hay. These areas, which are called meadows, commonly occur where the water table is high (fig. 9). They are associated with the Wet Land, Wet Subirrigated, Subirrigated, and Saline Subirrigated range sites. The dominant vegetation in meadows includes big bluestem, little bluestem, indiangrass, switchgrass, alkali sacaton, prairie cordgrass, and various members of the sedge family. Mowing has reduced the large population of native forbs (wildflowers).

Production in native meadows can be maintained or improved by proper haying management. The optimum time for mowing is prior to the emergence of the seedhead's flowers. Maximum storage of carbohydrates occurs when the seed is ripe or mature. This period coincides with the frost period for the dominant grasses. If the meadows are cut earlier, the grasses are higher in quality, and this is reflected later through livestock performance.

Mowing height is important in maintaining the stands of grasses and high forage production. Meadows should not be mowed closer than 3 inches to maintain high plant vigor.

Meadows should not be grazed when the soil is wet or when the water table is within 6 inches of the surface. Grazing at those times could result in the formation of small bogs or mounds and the consequent difficulty in mowing. Meadows can be grazed for the aftermath or regrowth after frost.

At the end of each map unit description, the soil or soils in that unit are placed in an appropriate range site according to the kind and amount of vegetation that is grown on the soil if the site is in climax condition. The interpretations for each range site in the county are in the Technical Guide, which is available at the local office of the Soil Conservation Service. Livestock farmers and others who want technical help with reseeding cropland

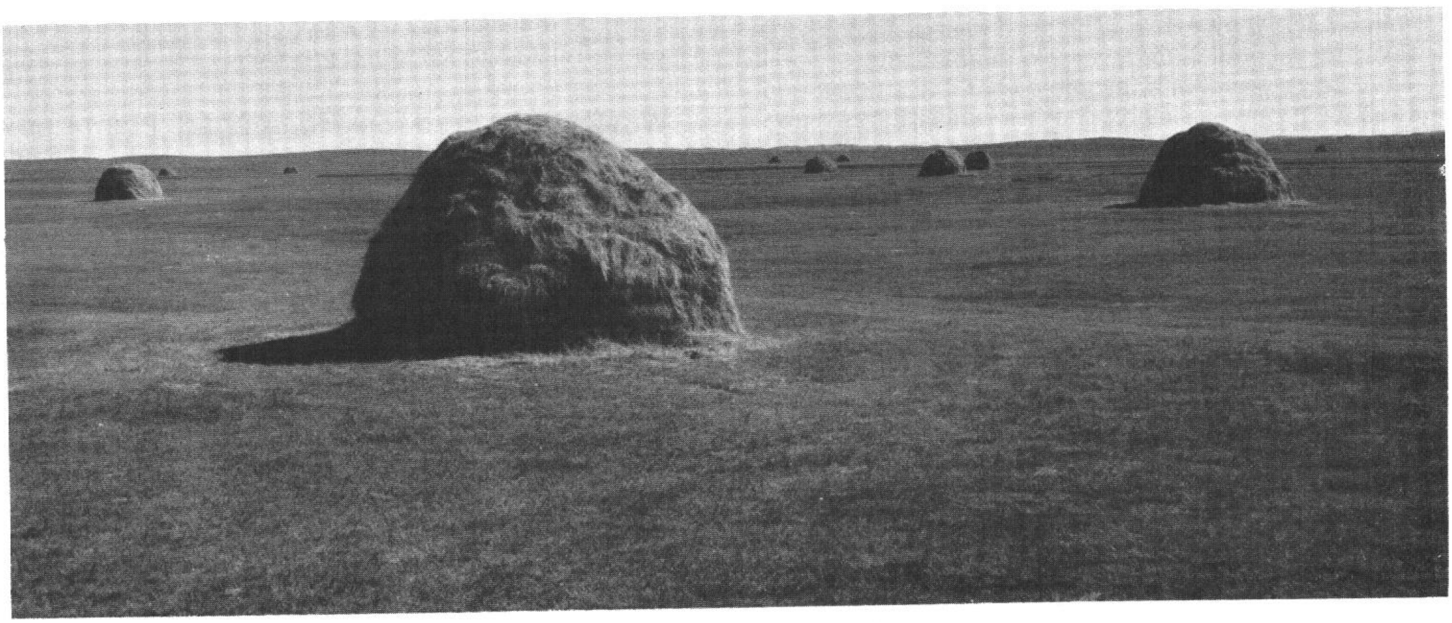

Figure 9.—Janise loam, 0 to 2 percent slopes, is commonly used for production of native hay. The soil is strongly alkali and has a seasonal high water table.

to rangeland, with setting up a planned grazing system, or with other aspects of a range program should contact the local office of the Soil Conservation Service.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 8 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Native Woodland

Prepared by Keith A. Ticknor, forester, Soil Conservation Service.

Very little native woodland occurs in Box Butte County. Black willow and eastern cottonwood are along the bottom lands of the Niobrara River, Box Butte Creek, and Dry Creek. Skunkbush sumac is in most of the steep canyon areas.

The native trees are mostly scattered and do not make up a sufficiently large concentration to have commercial value for wood products.

Windbreaks and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Most of the ranch headquarters and farmsteads in Box Butte County are surrounded by trees, which were planted at various times since the headquarters were established (fig. 10). Also, many 8- to 10-row shelterbelts have been planted throughout the county. Few trees or shrubs grow naturally in the county.

In order for windbreaks to fulfill their intended purpose, the species of trees or shrubs selected should be suited to the soil on which they are planted. Selecting suitable species helps to obtain maximum survival and growth rates. Permeability, available water capacity, and fertility greatly affect the growth rate of trees and shrubs.

An insufficient amount of moisture in the county affects the survival rate. Drip irrigation helps to overcome the moisture deficiency. Proper site preparation prior to planting and control of weeds or other competing plants

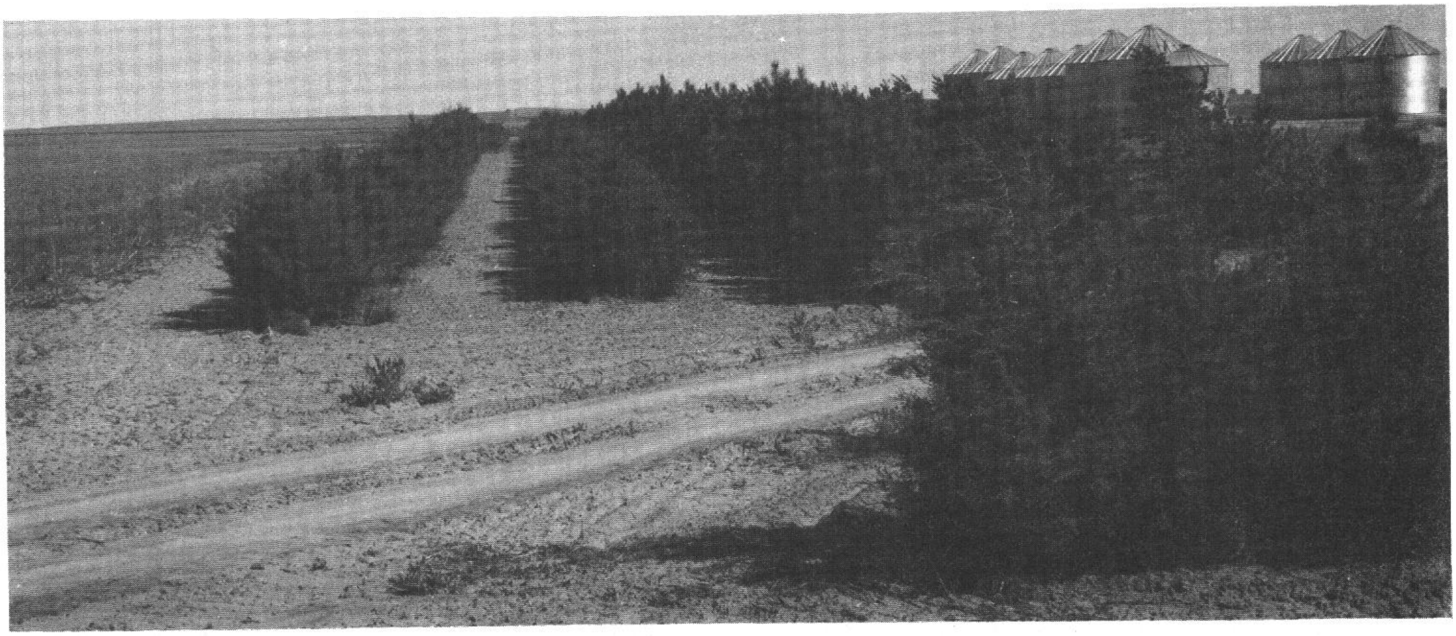

Figure 10.—This windbreak of redcedar and ponderosa pine on Alliance loam, 1 to 3 percent slopes, helps to protect a farmstead.

after planting are the major needs when a windbreak is established and managed.

Many of the older windbreaks and shelterbelts are deteriorating because they are crowded or because short-lived trees and shrubs have reached or passed maturity. Renovation is needed to restore the effectiveness of the windbreaks.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Recreation

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

The recreation activities available in Box Butte County include swimming, waterskiing, fishing, picnicking, hiking, and camping, and hunting for big game, small game, and waterfowl.

The city of Alliance has an excellent park system that includes picnic sites, a swimming pool, softball fields, and a golf course. Jogging trails and nature study areas are available also.

Box Butte County offers some of the best pheasant hunting in the state. Big game hunting for antelope, white-tailed deer, and mule deer is available during regular seasons. Doves and, to a lesser extent, sharp-tailed grouse provide sport for the hunter during regular seasons.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the

ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available

water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, smooth brome, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, green ash, honeylocust, apple, hawthorn, dogwood, hickory, willow, and eastern cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and wild plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, prairie cordgrass, rushes, sedges, and reedgrasses.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, skunk, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, coyote, woodcock, thrushes, woodpeckers, squirrels, red fox, raccoon, deer, and opposum.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, badger, deer, prairie grouse, meadowlark, and long-billed curlew.

The 11 soil associations on the general soil map can be grouped, as follows, according to the wildlife habitat they support.

The Las Animas-Lisco association includes bottom lands of the Niobrara River Valley. It is mainly in native grassland. In Box Butte County, the upper end of the Niobrara River is very narrow, and very few trees are along this stretch of the river. Rangeland wildlife—antelope, white-tailed deer, and mule deer—are in this association. Wet areas on the bottom lands harbor waterfowl, shore birds, mink, muskrats, beaver, raccoon, and oppossum.

The Busher-Valent-Tassel association, the Norrest-Canyon-Creighton association, the Sarben-Busher association, the Valent-Dailey association, and the Valentine association have many rangeland widelife species, mainly antelope, white-tailed deer, mule deer, prairie grouse, meadowlark, lark bunting, prairie dog, coyote, cottontail, and jackrabbits. Trees and shrubs occur only where they have been planted, and these are confined mainly to farmsteads and field windbreaks. The main species are redcedar, ponderosa pine, native plum, chokecherry, hackberry, caragana, and Siberian elm. Most of these plantings were planted as a part of the Prairie States Forestry Project and are about the same age. Some of the shelterbelts have golden flowering currant as an understory plant, which makes good food and cover for many kinds of wildlife. Along some drainageways, native skunkbush sumac is common. This provides browse for deer as well as food for birds and other small animals.

The Alliance-Rosebud-Keith association, the Creighton-Oglala-Canyon association, the Satanta-Jayem-Busher association, and the Alliance-Hemingford-Satanta association are primarily in cropland. Winter wheat-summer fallow is a common rotation under dryland farming. Field beans, corn, sugar beets, and alfalfa are grown under irrigation. This cropland provides a variety of cover and food for openland wildlife, such as pheasants and songbirds. Wheat is grown in rotation

with fallow and is generally stripcropped to help control soil blowing. The stripcropping provides diversity of wildlife habitat. Field windbreaks and farmstead shelterbelts, along with scattered trees and shrubs in fence rows and roadside ditches, provide additional cover that is especially important in winter. Some of the side drainageways of Box Butte Creek have a perched water table. This creates wetland areas, which attract both waterfowl and shore birds.

The Janise-Lisco association is along Snake Creek and is primarily in grassland. Marshy areas occur where the water table is at or near the surface. Cattails and other wetland vegetation are in these areas. Waterfowl, shore birds, mink, muskrat, weasel, skunk, opossum, and raccoon are common here, along with an abundance of small mammals.

All the associations support habitat for mourning doves.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to

sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction

problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3

feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and

depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69.

The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months;

November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

Samples from soil profiles were collected for physical and chemical analysis by the Soil Conservation Service, Soil Survey Laboratory, Lincoln, Nebraska. Soils of the Keith, Rosebud, and Valentine series were sampled in nearby counties of Nebraska. These data are recorded in Soil Survey Investigations Report Number 5 (*9*). Soil Survey Investigations Report Number 4 (*8*) provides data on Keith soils sampled in Kansas. Report Number 8 (*10*) provides data on Rosebud soils sampled in Wyoming. Report Number 10 (*11*) provides data on Keith and Richfield soils sampled in Colorado. Report Number 32 (*14*) provides data on Busher, Creighton, Keith, and Valent soils sampled in Wyoming.

This information is useful to soil scientists in classifying soils and developing concepts of soil genesis. It is also helpful in estimating available water capacity, susceptibility to soil blowing, fertility, tilth, organic matter content, and other properties that affect soil management. Reaction, electrical conductivity, and percentage of exchangeable sodium are laboratory data that are helpful in evaluating the possibility of reclaiming and managing saline-alkali soils.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. Most of the pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Specific gravity—T 100 75 (AASHTO).

The group index number that is part of the AASHTO classification is computed by using the Nebraska Modified System.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Psamment (*Psamm*, meaning sand, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Ustipsamments (*Ust*, meaning intermittently dry, plus *psamment*, the suborder of the Entisols that have a sandy texture).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Ustipsamments.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is mixed, mesic Typic Ustipsamments.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*7*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*13*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alliance Series

The Alliance series consists of deep, well drained, moderately permeable soils on loess-covered uplands. The upper part of the profile formed in loess, and the lower part formed in calcareous loamy material weathered from the underlying fine-grained sandstone (fig. 11). Slopes range from 0 to 11 percent.

Alliance soils are similar to Duroc, Goshen, and Keith soils and are commonly adjacent to Creighton, Duroc, Hemingford, Keith, and Rosebud soils on the landscape. Duroc soils have a mollic epipedon thicker than 20 inches and are slightly lower on the landscape than

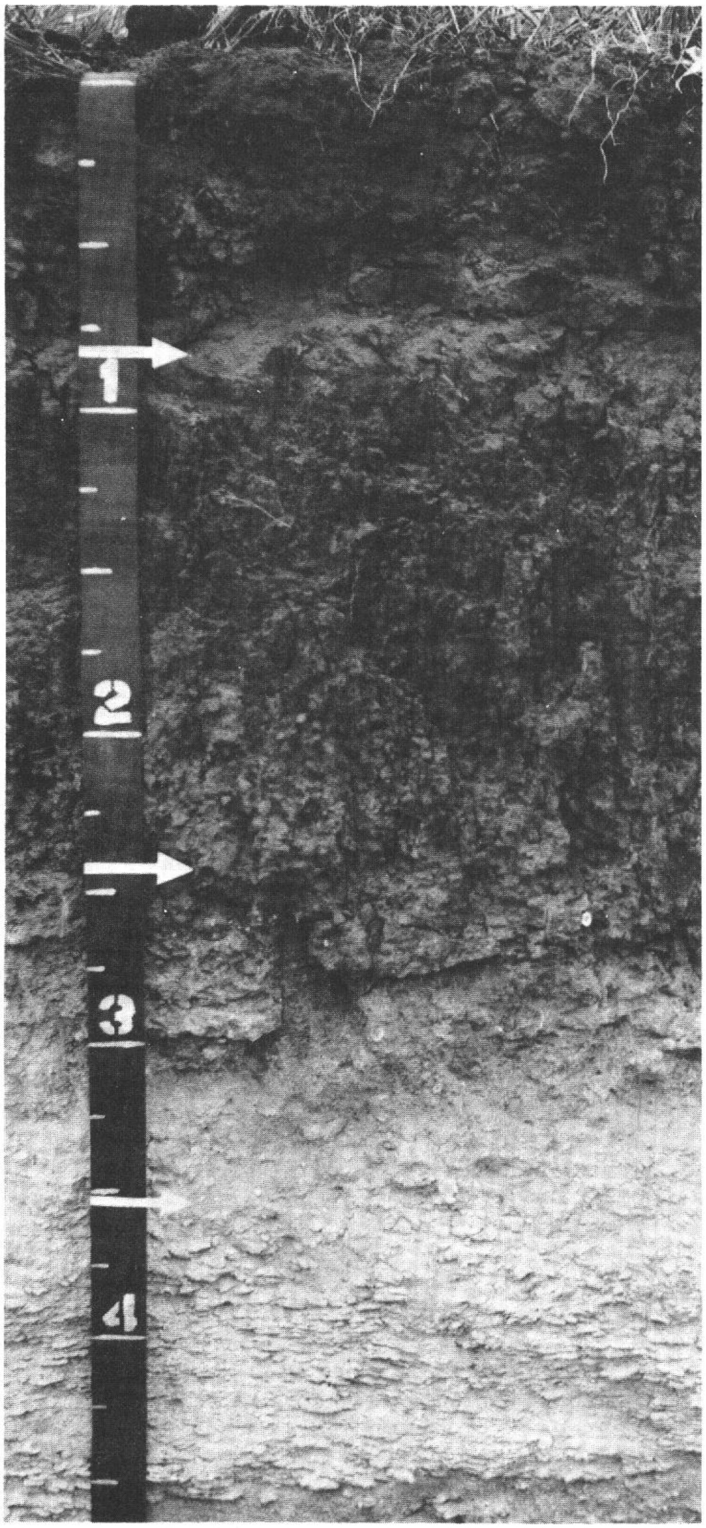

Figure 11.—Profile of Alliance loam, a deep, well drained soil. Soft, weakly cemented sandstone is at a depth of 42 inches. The depth is marked in feet.

Alliance soils. Goshen and Keith soils do not have weakly cemented sandstone above a depth of 60 inches. Also, Goshen soils are slightly lower on the landscape. Creighton soils do not have an argillic horizon and have less clay in the control section. Hemingford and Rosebud soils have more sand in the Bt horizon. Rosebud soils are moderately deep over sandstone.

Typical pedon of Alliance loam, 1 to 3 percent slopes, 500 feet west and 1,500 feet south of the northeast corner, section 2, T. 25 N., R. 49 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—5 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; neutral; clear smooth boundary.

Bt—8 to 16 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; neutral; clear smooth boundary.

BC—16 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; moderately alkaline; clear smooth boundary.

C1—20 to 34 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C2—34 to 46 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; many fine and medium sandstone fragments; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—46 to 60 inches; white (10YR 8/2) weakly cemented limy sandstone; violent effervescence.

The thickness of the solum and the depth to free carbonates range from 16 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). It is typically loam, but the range includes very fine sandy loam and fine sandy loam. Reaction is neutral or mildly alkaline. The Bt horizon has value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). Texture is typically silty clay loam, but the range includes silt loam. The Bt horizon averages between 25 and 35 percent clay. Reaction is neutral or mildly alkaline. The C horizon has value of 6 through 8 (5 or 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the

range includes loam, fine sandy loam, and loamy very fine sand. Reaction is mildly alkaline or moderately alkaline. Weakly cemented, limy sandstone is at a depth of 40 to 60 inches.

Bankard Series

The Bankard series consists of deep, somewhat excessively drained, rapidly permeable soils on bottom lands. These soils formed in sandy alluvial material along drainageways. Slopes range from 0 to 3 percent.

Bankard soils are commonly adjacent to Craft, Las Animas, and Valent soils on the landscape. Craft soils have less sand and more clay in the control section than Bankard soils. Las Animas soils have more silt and clay in the profile, are somewhat poorly drained, and are on the lower part of the landscape. Valent soils do not have stratification in the profile and are higher on the landscape.

Typical pedon of Bankard very fine sandy loam, 0 to 3 percent slopes, 500 feet east and 500 feet north of the southwest corner of section 14, T. 28 N., R. 49 W.

A—0 to 4 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

C1—4 to 18 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine and coarse subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—18 to 60 inches; light gray (10YR 7/2) fine sand stratified with thin lenses of loamy very fine sand, grayish brown (10YR 5/2) moist; single grained; loose; common fine and medium sandstone fragments; strong effervescence; mildly alkaline.

The thickness of the ochric epipedon ranges from 4 to 7 inches, and the depth to free carbonates ranges from 0 to 6 inches.

The A horizon has value of 5 or 6 (3 or 4, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes fine sandy loam, loamy fine sand, and fine sand. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy fine sand and fine sand stratified with lenses of loamy very fine sand, but the range includes sand and gravelly coarse sand. Fragments of sandstone are common.

Bridget Series

The Bridget series consists of deep, well drained, moderately permeable soils on foot slopes, on stream terraces, and in some places along the bottom of upland drainageways. These soils formed in loamy, calcareous, colluvial-alluvial material. Slopes range from 0 to 6 percent.

Bridget soils are similar to Creighton, McCook, and Oglala soils and are commonly adjacent to Busher, Craft, Creighton, Oglala, and Rosebud soils on the landscape. Creighton soils have a B horizon and are slightly higher on the landscape than Bridget soils. McCook soils are stratified and are on bottom lands. Busher and Oglala soils are 40 to 60 inches deep to weakly cemented sandstone and are higher on the landscape. In addition, Busher soils have more sand and less clay in the control section. Craft soils do not have a mollic epipedon, are stratified, and are on bottom lands. Rosebud soils have more clay in the solum, are 20 to 40 inches deep to sandstone, and are higher on the landscape.

Typical pedon of Bridget very fine sandy loam, 1 to 3 percent slopes, 2,450 feet south and 600 feet west of the northeast corner of section 6, T. 28 N., R. 49 W.

Ap—0 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—10 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

AC—14 to 19 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—19 to 26 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; violent effervescence; mildly alkaline; clear smooth boundary.

C2—26 to 43 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C3—43 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 8 to 28 inches, and the depth to free carbonates ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loam and silt loam. Reaction is neutral or mildly alkaline. The C horizon has

value of 6 through 8 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam or loam, but the range includes thin layers of fine sandy loam and silt loam.

Busher Series

The Busher series consists of deep, well drained soils on uplands. Permeability is moderately rapid. These soils formed in material weathered from weakly cemented sandstone. Slopes range from 0 to 30 percent.

Busher soils are similar to Creighton, Jayem, and Sarben soils and are commonly adjacent to Creighton, Jayem, Sarben, Tassel, and Valent soils on the landscape. Creighton and Jayem soils are 60 inches deep or deeper to weakly cemented sandstone. In addition, Jayem soils have free carbonates below a depth of 40 inches. Sarben soils do not have a mollic epipedon, and they are 60 inches deep or deeper to cemented sandstone. Tassel soils do not have a mollic epipedon, they are 8 to 20 inches deep to weakly cemented sandstone, and they are higher on the landscape than Busher soils. Valent soils have more sand in the control section and do not have a mollic epipedon.

Typical pedon of Busher loamy very fine sand in an area of Busher-Jayem loamy very fine sands, 3 to 6 percent slopes, 225 feet east and 650 feet south of the northwest corner of section 17, T. 28 N., R. 51 W.

A—0 to 11 inches; grayish brown (10YR 5/2) loamy very fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

Bw—11 to 23 inches; brown (10YR 5/3) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; mildly alkaline; clear smooth boundary.

C1—23 to 28 inches; pale brown (10YR 6/3) loamy very fine sand, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; common medium sandstone fragments; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—28 to 56 inches; light gray (10YR 7/2) loamy very fine sand, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; common medium sandstone fragments; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—56 to 60 inches; white (10YR 8/2) weakly cemented limy sandstone; violent effervescence.

The thickness of the solum ranges from 16 to 34 inches, and the depth to free carbonates ranges from 18 to 36 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is dominantly loamy very fine sand, but the range includes very fine sandy loam and fine sandy loam. Reaction is neutral or mildly alkaline. The Bw horizon has value of 5 or 6 (4 or 5, moist) and chroma of 2 or 3 (dry or moist). Texture is typically loamy very fine sand, but the range includes fine sandy loam and very fine sandy loam. Reaction is neutral or mildly alkaline. The C horizon has value of 5 through 8 (4 through 7, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy very fine sand, but the range includes very fine sand and very fine sandy loam. Reaction is mildly alkaline or moderately alkaline. Weakly cemented, limy sandstone is at a depth of 40 to 60 inches.

In map units SbB and SbD, the surface layer is thinner and lighter colored than is defined as the range for the Busher series, but this difference does not alter the use or behavior of the soils.

Canyon Series

The Canyon series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in loamy residuum of the underlying fine-grained sandstone (fig. 12). Slopes range from 3 to 30 percent.

Canyon soils are similar to Tassel soils and are commonly adjacent to Alliance, Creighton, Norrest, Oglala, and Rosebud soils on the landscape. Tassel soils have more sand and less clay in the control section and are higher on the landscape than Canyon soils. Alliance soils have a mollic epipedon, are deep to bedrock, have more silt and clay in the control section, and are generally slightly higher on the landscape. Creighton and Oglala soils are deep to sandstone bedrock and have a mollic epipedon. In addition, Oglala soils are slightly lower on the landscape. Norrest soils are 20 to 40 inches deep to clayey siltstone and have more silt and clay in the control section. Rosebud soils are 20 to 40 inches deep to sandstone, have a mollic epipedon, and are generally slightly lower on the landscape.

Typical pedon of Canyon very fine sandy loam, 3 to 30 percent slopes, 200 feet south and 1,800 feet east of the northwest corner of section 36, T. 26 N., R. 49 W.

A—0 to 4 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak very fine granular; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

AC—4 to 7 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist, weak medium subangular blocky structure parting to weak fine granular; soft, very friable; many fine

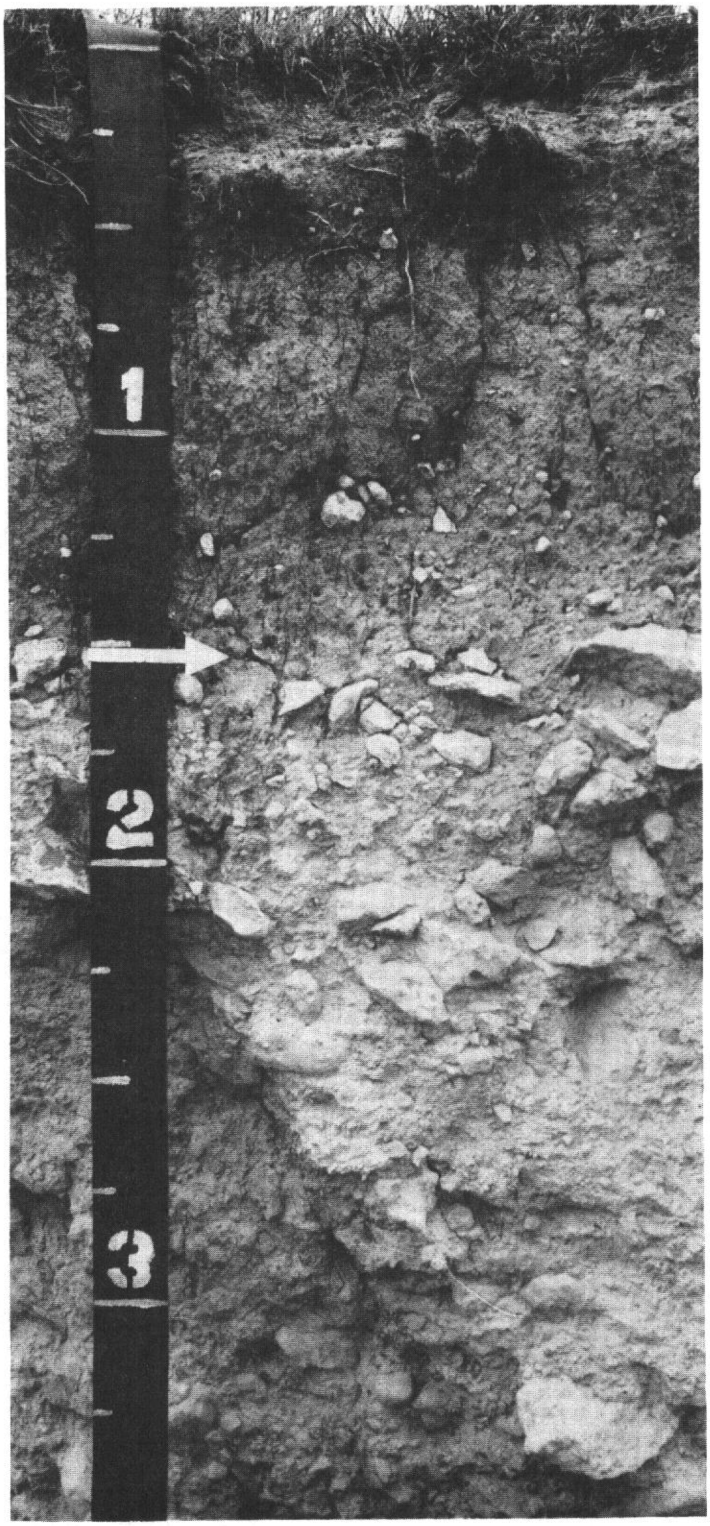

Figure 12.—Profile of Canyon very fine sandy loam, a shallow, well drained soil. Soft, weakly cemented sandstone is at a depth of 18 inches. The depth is marked in feet.

fragments of sandstone; violent effervescence; mildly alkaline; clear smooth boundary.

C—7 to 14 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; many fine fragments of sandstone; violent effervescence; mildly alkaline; clear smooth boundary.

Cr—14 to 60 inches; white (10YR 8/2) weakly cemented limy sandstone; violent effervescence.

The thickness of the solum ranges from 6 to 12 inches, and the depth to free carbonates ranges from 0 to 6 inches. The thickness of the ochric epipedon ranges from 3 to 6 inches, and the depth to bedrock ranges from 8 to 20 inches.

The A horizon has value of 4 through 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 6 through 8 (4 through 7, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loam. Reaction is mildly alkaline or moderately alkaline. The C horizon ranges from 12 to 25 percent clay.

Craft Series

The Craft series consists of deep, well drained, moderately permeable soils on bottom lands. These soils formed in stratified, calcareous alluvium. Slopes range from 0 to 3 percent.

Craft soils are similar to McCook soils and are commonly adjacent to Bankard, Bridget, and Janise soils on the landscape. McCook soils have a mollic epipedon. Bankard soils have more sand in the control section than Craft soils. Bridget soils are not stratified and have a mollic epipedon. Janise soils are very strongly alkaline and are slightly lower on the landscape.

Typical pedon of Craft very fine sandy loam, 0 to 3 percent slopes, 2,000 feet north and 500 feet east of the southwest corner of section 1, T. 26 N., R. 49 W.

A—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak very fine granular; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—5 to 8 inches; grayish brown (10YR 5/2) very fine sandy loam stratified with thin lenses of gravelly very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C1—8 to 22 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and fine subangular blocky

structure; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—22 to 33 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C3—33 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 4 to 20 inches, and the depth to free carbonates ranges from 0 to 10 inches. The thickness of the ochric epipedon ranges from 4 to 12 inches.

The A horizon has value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loam and loamy very fine sand. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 1 through 3 (dry or moist). It is typically very fine sandy loam, but it can include strata of loam, loamy very fine sand, and silt loam. Reaction is mildly alkaline or moderately alkaline.

Creighton Series

The Creighton series consists of deep, well drained, moderately permeable soils on uplands, on stream terraces, and on foot slopes. These soils formed in eolian and colluvial-alluvial material weathered from fine-grained sandstone. Slopes range from 0 to 30 percent.

Creighton soils are similar to Bridget, Busher, and Oglala soils and are commonly adjacent to Alliance, Bridget, Canyon, Norrest, and Oglala soils on the landscape. Bridget soils do not have a cambic horizon and are slightly lower on the landscape than Creighton soils. Busher and Oglala soils are 40 to 60 inches deep to weakly cemented sandstone. Alliance soils have more clay in the B horizon. Canyon soils are shallow over bedrock and are higher on the landscape. Norrest soils have more clay in the B horizon, are moderately deep over clayey siltstone, and are generally lower on the landscape than Creighton soils. Canyon and Norrest soils also do not have a mollic epipedon.

Typical pedon of Creighton very fine sandy loam, 1 to 3 percent slopes (fig. 13), 225 feet south and 550 feet east of the northwest corner of section 24, T. 25 N., R. 49 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

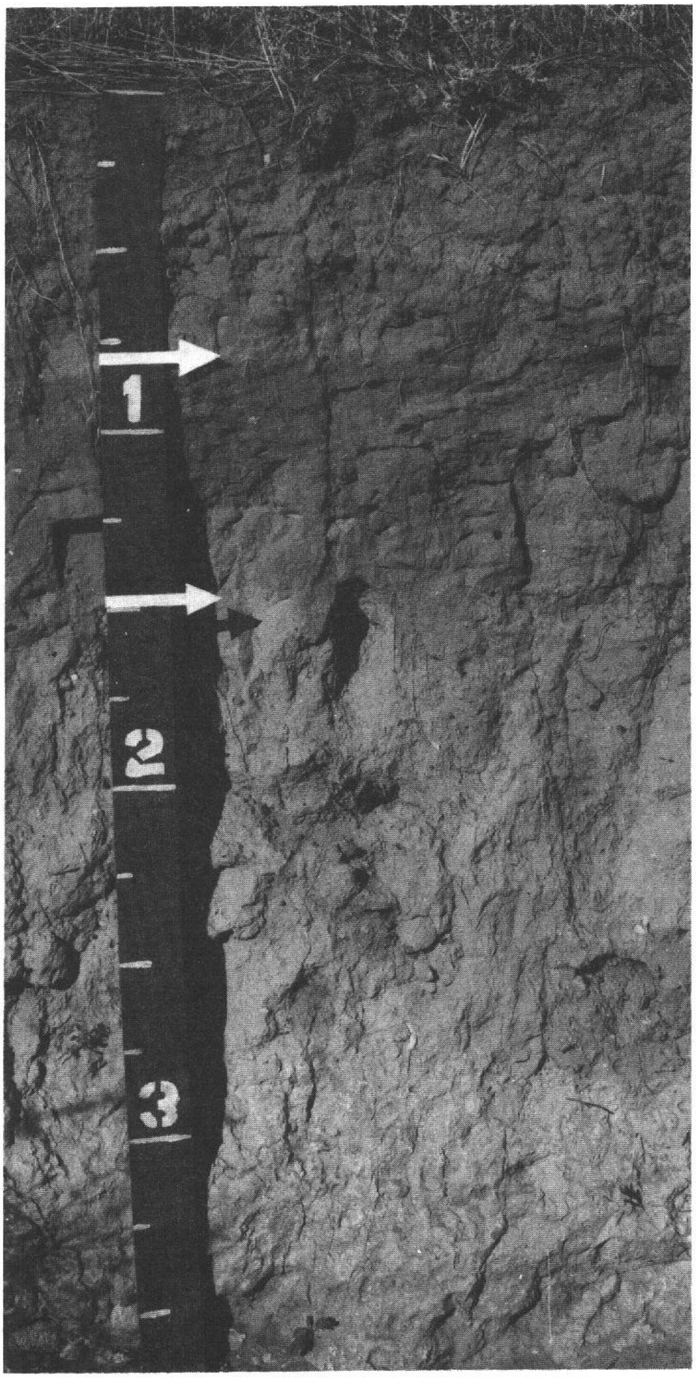

Figure 13.—Profile of Creighton very fine sandy loam, a deep, well drained soil that has a weakly developed subsoil. The depth is marked in feet.

Bw1—8 to 15 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

Bw2—15 to 20 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse and medium subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.
C—20 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 28 inches, and the depth to free carbonates ranges from 7 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). Texture is typically very fine sandy loam, but the range includes loam and fine sandy loam. Reaction is neutral or mildly alkaline. The Bw horizon has value of 5 or 6 (4 or 5, moist) and chroma of 2 or 3 (dry or moist). Texture is typically very fine sandy loam, but the range includes loam and fine sandy loam. The Bw horizon averages between 6 and 16 percent clay. Reaction ranges from neutral through moderately alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). Texture is typically very fine sandy loam, but the range includes fine sandy loam, loamy very fine sand, and loam. Reaction is moderately alkaline or strongly alkaline.

Dailey Series

The Dailey series consists of deep, somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in sandy eolian sediment. Slopes range from 0 to 9 percent.

Dailey soils are similar to Valent and Valentine soils and are commonly adjacent to Jayem, Valent, and Valentine soils on the landscape. Valent and Valentine soils do not have a mollic epipedon, are excessively drained, and are on slightly higher parts of the landscape than Dailey soils. Jayem soils have more silt, generally have less sand, have a cambic horizon, and are lower on the landscape.

Typical pedon of Dailey loamy sand, 0 to 3 percent slopes, 275 feet north and 1,900 feet east of the southwest corner of section 19, T. 24 N., R. 48 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.
A—7 to 15 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; mildly alkaline; clear wavy boundary.
C—15 to 60 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grained; loose; mildly alkaline.

The mollic epipedon ranges from 10 to 20 inches in thickness. The depth to free carbonates ranges from 40 to more than 60 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). Texture is typically loamy sand, but the range includes loamy fine sand. Reaction is neutral or mildly alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy sand, but the range includes fine sand, sand, and loamy fine sand. Reaction is neutral or mildly alkaline.

Duroc Series

The Duroc series consists of deep, well drained, moderately permeable soils on bottom lands, on foot slopes, and in slightly concave areas of the uplands. These soils formed in loamy alluvium and colluvium. Slopes range from 0 to 3 percent.

Duroc soils are similar to Alliance, Goshen, and Keith soils and are commonly adjacent to Alliance, Goshen, Keith, McCook, and Rosebud soils on the landscape. Alliance, Goshen, and Keith soils have an argillic horizon, have a mollic epipedon less than 20 inches thick, and are higher on the landscape than Duroc soils. McCook soils have less clay in the control section, have a mollic epipedon less than 20 inches thick, and are slightly lower on the landscape. Rosebud soils are 20 to 40 inches deep to bedrock, have a mollic epipedon less than 20 inches thick, and are higher on the landscape.

Typical pedon of Duroc loam, 1 to 3 percent slopes, 1,850 feet west and 300 feet south of the northeast corner of section 32, T. 28 N., R. 51 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, friable; moderately alkaline; abrupt smooth boundary.
A—5 to 35 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; mildly alkaline; clear smooth boundary.
C—35 to 60 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 20 to 50 inches. The depth to free carbonates ranges from 20 to 36 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically loam, but

the range includes silt loam. Reaction ranges from neutral through moderately alkaline. The C horizon has value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically loam, but the range includes silt loam. Reaction is mildly alkaline or moderately alkaline.

Goshen Series

The Goshen series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in alluvial sediment derived mainly from loess. Slopes are 0 to 1 percent.

These Goshen soils have a thinner mollic epipedon than is defined in the range for the Goshen series, but this difference does not alter the use or behavior of the soils.

Goshen soils are similar to Alliance, Duroc, and Keith soils and are commonly adjacent to Craft, Duroc, McCook, and Satanta soils on the landscape. Alliance soils are 40 to 60 inches deep to weakly cemented sandstone and are higher on the landscape than Goshen soils. Duroc soils have a mollic epipedon thicker than 20 inches and do not have a B horizon. Keith soils do not have pebbles or stratification in the underlying material and are higher on the landscape. Craft soils do not have a mollic epipedon, have less clay in the control section, and are lower on the landscape. McCook soils are stratified, have less clay in the control section, and are slightly lower on the landscape. Satanta soils have more sand and less clay in the control section and are slightly higher on the landscape.

Typical pedon of Goshen loam, 0 to 1 percent slopes, 2,150 feet south and 1,150 feet east of the northwest corner of section 11, T. 24 N., R. 49 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

A—6 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; mildly alkaline; clear smooth boundary.

Bt1A—9 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine subangular blocky structure; hard, friable; moderately alkaline; clear smooth boundary.

Bt2—15 to 24 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable; moderately alkaline; clear wavy boundary.

Bck—24 to 35 inches; light gray (2.5Y 7/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—35 to 53 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline; clear wavy boundary.

C2—53 to 60 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; 5 percent pebbles; violent effervescence; strongly alkaline.

The thickness of the solum ranges from 24 to 42 inches. The depth to free carbonates ranges from 24 to 36 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically loam, but the range includes silt loam. Reaction is neutral or mildly alkaline. The Bt horizon has value of 4 through 6 (3 or 4, moist) and chroma of 2 or 3 (dry or moist). It is typically silt loam and silty clay loam, but the range includes loam. It averages between 20 and 30 percent clay. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 6 or 7 (5 or 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes silt loam and loam. Reaction is mildly alkaline or moderately alkaline above a depth of 4 feet and is moderately alkaline or strongly alkaline below this depth.

Hemingford Series

The Hemingford series consists of deep, well drained soils on uplands. Permeability is moderately slow. The upper part of the profile formed in loess, and the lower part formed in loamy material weathered from clayey siltstone and fine-grained sandstone. Slopes range from 0 to 6 percent.

Hemingford soils are similar to the Rosebud and Satanta soils and are commonly adjacent to Alliance, Duroc, Manter, Rosebud, and Satanta soils on the landscape. Rosebud soils are 20 to 40 inches deep to soft sandstone. Satanta soils have less clay and more sand in the control section, do not have bedrock in the profile, and are slightly higher on the landscape than Hemingford soils. Alliance soils have less sand in the subsoil and less clay in the C horizon. Duroc soils have a surface soil over 20 inches thick, have less clay in the control section, and are slightly lower on the landscape. Manter soils have more sand in the control section and are higher on the landscape.

Typical pedon of Hemingford loam, 0 to 1 percent slopes, 2,350 feet east and 150 feet north of the southwest corner of section 15, T. 27 N., R. 47 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak

very fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—6 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; neutral; clear smooth boundary.

Bt—10 to 18 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; very hard, firm; neutral; gradual smooth boundary.

BC—18 to 25 inches; light brownish gray (2.5Y 6/2) sandy clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; slight effervescence; mildly alkaline; clear smooth boundary.

Ck—25 to 42 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; weak coarse and medium subangular blocky structure; hard, firm; few fine and medium sandstone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

Cr—42 to 60 inches; white (2.5Y 8/2) soft sandstone, light gray (2.5Y 7/2) moist; strong effervescence.

The thickness of the solum ranges from 12 to 34 inches, and the depth to free carbonates ranges from 12 to 24 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). It is typically loam, but the range includes very fine sandy loam and fine sandy loam. The Bt horizon has value of 4 through 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically clay loam, but the range includes sandy clay loam and loam. It averages between 25 and 35 percent clay. Reaction is neutral or mildly alkaline. The C horizon has value of 6 through 8 (5 through 7, moist) and chroma of 2 or 3 (dry or moist). It is typically sandy clay loam, but the range includes loam, very fine sandy loam, and fine sandy loam. Reaction is mildly alkaline or moderately alkaline. Weakly cemented, limy sandstone is at a depth of 40 to 60 inches.

Hoffland Series

The Hoffland series consists of deep, very poorly drained, rapidly permeable soils in valleys and depressions of the sandhills. These soils formed in sandy and loamy alluvial or eolian material. Slopes are 0 to 1 percent.

Hoffland soils are commonly adjacent to Ipage, Lisco, Marlake, and Valentine soils on the landscape. Ipage and Valentine soils are better drained and are higher on the landscape than Hoffland soils. Lisco soils are better drained, have a B horizon, have higher reaction in the solum, and are slightly higher on the landscape. In addition, they have more silt and clay in the control section and are alkali. Marlake soils have a higher water table, are stratified, and are slightly lower on the landscape.

Typical pedon of Hoffland fine sandy loam, wet, 0 to 1 percent slopes, 2,275 feet south and 1,875 feet east of the northwest corner of section 1, T. 24 N., R. 47 W.

O—1 inch to 0; partially decomposed organic matter; strong effervescence.

Ak—0 to 5 inches; gray (10YR 5/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—5 to 16 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—16 to 42 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common fine distinct dark brown (10YR 3/3) mottles; single grained; loose; slight effervescence; moderately alkaline; clear smooth boundary.

Ab—42 to 51 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; massive; slightly hard, very friable; slight effervescence; mildly alkaline; gradual wavy boundary.

C—51 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 4 to 10 inches, and the thickness of the ochric epipedon ranges from 3 to 6 inches. Free carbonates are at the surface.

The Ak horizon has value of 3 through 5 (2 or 3, moist) and chroma of 1 through 3 (dry or moist). It is typically fine sandy loam, but the range includes very fine sandy loam and loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 1 through 3 (dry or moist). Texture is fine sand or loamy fine sand. Below a depth of 3 feet the texture ranges from fine sandy loam to fine sand. Reaction is mildly alkaline or moderately alkaline.

Imlay Series

The Imlay series consists of shallow, well drained, slowly permeable soils on uplands. These soils formed in residuum of clayey siltstone. Slopes range from 11 to 60 percent.

These Imlay soils have less coarse fragments than is defined in the range for the Imlay series, but this difference does not alter the use or behavior of the soils.

Imlay soils are commonly adjacent to Busher, Creighton, Norrest, and Tassel soils on the landscape. Busher soils are deep, have a mollic epipedon, have less clay and more sand in the control section, and are lower on the landscape than Imlay soils. Creighton soils are deep, have less clay and more sand in the control section, and generally are higher on the landscape. Norrest soils are moderately deep over clayey siltstone. Tassel soils have more sand in the control section, are shallow to sandstone, and are slightly lower on the landscape.

Typical pedon of Imlay loam in an area of Imlay-Rock outcrop complex, 11 to 60 percent slopes, 1,900 feet north and 350 feet west of the southeast corner of section 33, T. 28 N., R. 52 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak fine granular structure; slightly hard, friable; few fine siltstone fragments; violent effervescence; moderately alkaline; abrupt smooth boundary.

C—3 to 12 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; strong coarse prismatic structure parting to strong medium subangular blocky; hard, firm; common fine siltstone fragments; violent effervescence; moderately alkaline; clear smooth boundary.

Cr—12 to 60 inches; light olive gray (5Y 6/2) clayey siltstone; very hard; violent effervescence.

The thickness of the ochric epipedon ranges from 2 to 8 inches. Free carbonates are at the surface. The depth to siltstone ranges from 8 to 20 inches.

The A horizon has value of 4 through 6 (3 through 5, moist) and chroma of 1 or 2 (dry or moist). Texture is typically loam, but the range includes silt loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically clay loam, but in some pedons it is silty clay loam. It averages between 27 and 34 percent noncarbonate clay. Reaction is mildly alkaline or moderately alkaline. The C horizon typically contains less than 35 percent, by volume, coarse fragments.

Ipage Series

The Ipage series consists of deep, moderately well drained, rapidly permeable soils in sandhills, in valleys, and on stream terraces. These soils formed mainly in eolian sand. Slopes range from 0 to 3 percent.

Ipage soils are commonly adjacent to Janise, Lisco, Valent, and Valentine soils on the landscape. Janise and Lisco soils have more clay and less sand in the control section, have a solum that is strongly and very strongly saline-alkali, and are slightly lower on the landscape than Ipage soils. Valent and Valentine soils are excessively drained, are not mottled above a depth of 40 inches, and are higher on the landscape.

Typical pedon of Ipage loamy fine sand, alkali substratum, 0 to 3 percent slopes, 325 feet north and 550 feet west of the southeast corner of section 15, T. 24 N., R. 49 W.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

AC—6 to 13 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; moderately alkaline; clear smooth boundary.

C1—13 to 35 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—35 to 39 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; strong effervescence; very strongly alkaline; gradual smooth boundary.

C3—39 to 60 inches; light gray (10YR 7/2) loamy fine sand, light brownish gray (10YR 6/2) moist; common fine distinct strong brown (7.5YR 5/6) mottles; massive; soft, very friable; strong effervescence; very strongly alkaline.

The thickness of the solum ranges from 10 to 18 inches, and the depth to free carbonates ranges from 2 to 24 inches. The thickness of the ochric epipedon ranges from 4 to 8 inches.

The A horizon has value of 4 or 5 (3 or 4, moist) and chroma of 1 or 2 (dry or moist). It is typically loamy fine sand, but the range includes fine sand. Reaction is neutral or mildly alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy fine sand, but the range includes fine sand. Reaction is moderately alkaline through very strongly alkaline.

Janise Series

The Janise series consists of deep, somewhat poorly drained soils on high bottom lands. The drained phases of the Janise soils are moderately well drained. Permeability is moderately slow. These soils formed in calcareous loamy alluvium and have saline-alkali characteristics. Slopes range from 0 to 3 percent.

Janise soils are similar to Lisco soils in saline-alkali characteristics and are commonly adjacent to Dailey, Ipage, Jayem, Lisco, and McCook soils on the

landscape. Lisco soils have more fine sand and less noncarbonate clay in the control section than Janise soils. Dailey and Jayem soils have more sand, are better drained, do not have saline-alkali characteristics, and are higher on the landscape. Ipage soils do not have a B horizon, have more sand in the control section, and are slightly higher on the landscape. McCook soils have a mollic epipedon, are better drained, do not have saline-alkali characteristics, and are slightly higher on the landscape.

Typical pedon of Janise loam, 0 to 2 percent slopes, 2,200 feet west and 1,050 feet south of the northeast corner of section 17, T. 24 N., R. 49 W.

E—0 to 2 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak medium platy structure; slightly hard, very friable; strong effervescence; strongly alkaline; abrupt smooth boundary.

Bw—2 to 6 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak fine prismatic structure parting to moderate fine subangular blocky; hard, friable; strong effervescence; very strongly alkaline; clear smooth boundary.

BC—6 to 14 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; violent effervescence; very strongly alkaline; clear smooth boundary.

C1—14 to 32 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; violent effervescence; very strongly alkaline; gradual smooth boundary.

C2—32 to 60 inches; light gray (10YR 7/2) very fine sandy loam, pale brown (10YR 6/3) moist; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive; slightly hard, very friable; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 6 to 24 inches, and the depth to free carbonates ranges from 0 to 6 inches. The thickness of the ochric epipedon ranges from 1 to 5 inches.

The E horizon has value of 5 or 6 (3 or 4, moist) and chroma of 1 or 2 (dry or moist). Texture is typically loam but is loamy fine sand in the overblown phases (fig. 14). The range includes silt loam, very fine sandy loam, and fine sandy loam. The range in reaction is wide, from neutral through very strongly alkaline. The Bw horizon has value of 5 through 7 (4 or 5, moist). It is typically silt loam, but the range includes loam and clay loam. Content of clay, including carbonate clay, averages between 18 and 28 percent. Reaction is strongly alkaline or very strongly alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). Texture in the C horizon is typically loam or very fine sandy loam, but the range includes silt loam. Below a depth of 40 inches the texture ranges from loam to fine sand. Reaction is strongly alkaline or very strongly alkaline.

Jayem Series

The Jayem series consists of deep, well drained soils on uplands. Permeabilty is moderately rapid. These soils formed in eolian material weathered from sandstone. Slopes range from 0 to 9 percent.

Jayem soils are similar to Busher, Creighton, and Vetal soils and are commonly adjacent to Busher, Dailey, Janise, Satanta, and Vetal soils on the landscape. Busher soils have carbonates higher in the profile than Jayem soils and are 40 to 60 inches deep to weakly cemented sandstone. Creighton soils are calcareous in the control section and are lower on the landscape. Vetal soils have a mollic epipedon thicker than 20 inches and are slightly lower on the landscape. Dailey soils have more sand in the control section and are slightly higher on the landscape. Janise soils have more clay in the control section, have saline-alkali characteristics, and are lower on the landscape. Satanta soils have more clay in the control section and are slightly lower on the landscape.

Typical pedon of the Jayem fine sandy loam, 0 to 3 percent slopes, 350 feet north and 1,150 feet east of the southwest corner of section 27, T. 24 N., R. 49 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

Bw—11 to 26 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; gradual smooth boundary.

C1—26 to 41 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; mildly alkaline; gradual smooth boundary.

C2—41 to 60 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 40 inches. The depth to free carbonates is more than 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically fine sandy loam, loamy fine sand, or loamy sand, but the range includes loamy very fine sand and very fine sandy loam. Reaction is neutral or mildly alkaline. The B horizon has

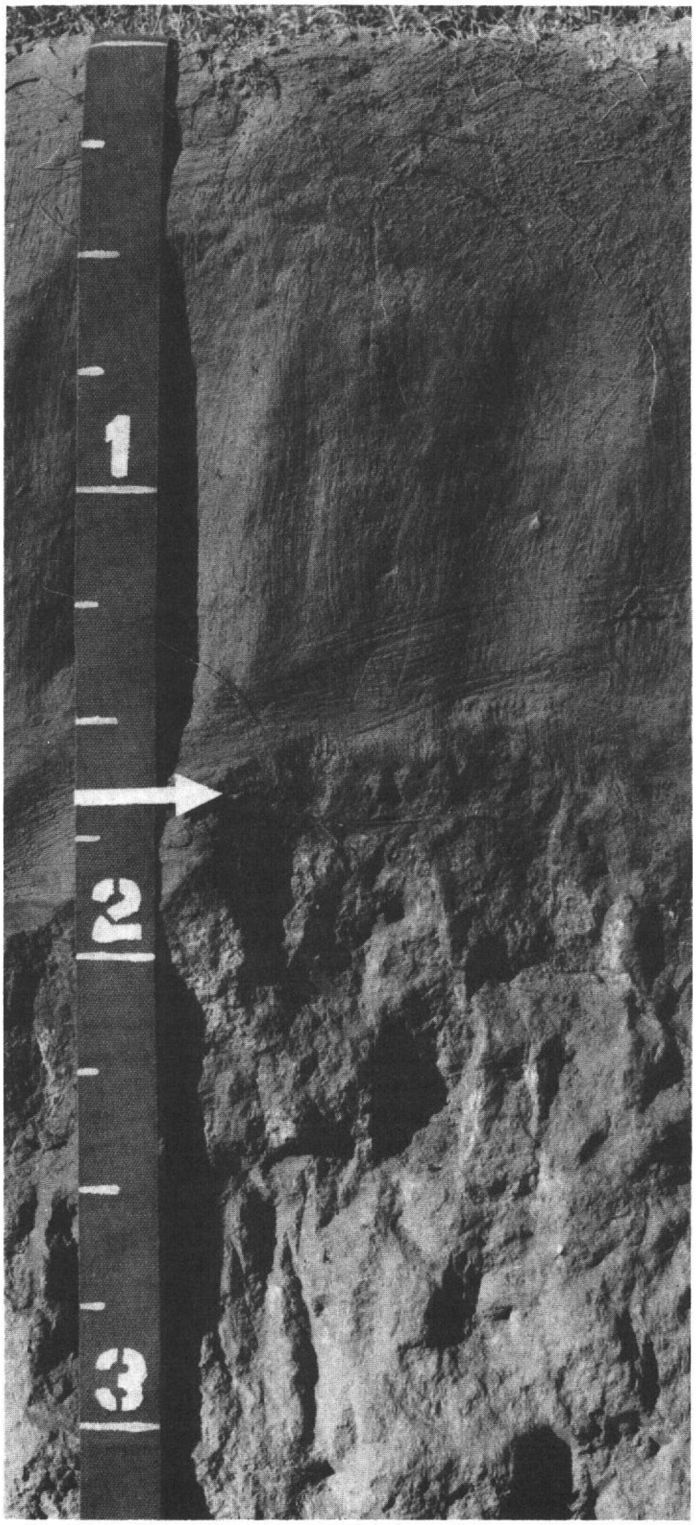

Figure 14.—Profile of Janise loamy fine sand, drained, overblown, 0 to 3 percent slopes. This deep, moderately well drained soil has about 20 inches of loamy fine sand on the surface. The depth is marked in feet.

value of 5 or 6 (4 or 5, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but in some pedons it is fine sandy loam, loam, or loamy very fine sand. It averages between 55 and 80 percent sand. Reaction is neutral or mildly alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loamy very fine sand, fine sandy loam, and loamy fine sand.

Keith Series

The Keith series consists of deep, well drained, moderately permeable soils on loess-covered uplands. Slopes range from 0 to 6 percent.

Keith soils are similar to Alliance, Duroc, Goshen, and Richfield soils and are commonly adjacent to Alliance, Creighton, Duroc, Richfield, and Satanta soils on the landscape. Alliance soils are 40 to 60 inches deep to weakly cemented sandstone. Duroc soils have a mollic epipedon thicker than 20 inches, do not have a B horizon, and are slightly lower on the landscape than Keith soils. Goshen soils have pebbles and fine stratification in the underlying material and are on stream terraces subject to rare flooding. Creighton soils have less clay in the control section. Richfield soils have more clay in the subsoil and are on low-lying uplands. Satanta soils have more sand and less clay in the control section and are generally higher on the landscape.

Typical pedon of Keith loam, 0 to 1 percent slopes, 1,150 feet east and 100 feet south of the northwest corner of section 12, T. 27 N., R. 52 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Bt1—8 to 19 inches; grayish brown (10YR 5/2) silty clay loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; mildly alkaline; clear smooth boundary.

Bt2—19 to 31 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; mildly alkaline; clear smooth boundary.

BCk—31 to 36 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C1—36 to 52 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—52 to 60 inches; white (10YR 8/2) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; few small sandstone fragments; moderately alkaline.

The thickness of the solum ranges from 18 to 36 inches. The depth to free carbonates ranges from 15 to 35 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). It is typically loam, but the range includes very fine sandy loam and silt loam. Reaction is slightly acid or neutral. The Bt horizon has value of 4 through 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically silty clay loam and silt loam. It averages between 25 and 33 percent clay. Reaction is neutral through moderately alkaline. The C horizon has value of 6 through 8 (5 or 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes silt loam and loam. Reaction is mildly alkaline or moderately alkaline.

Lamo Variant

The Lamo Variant consists of deep, poorly drained, moderately permeable soils on bottom lands along upland drainageways. These soils formed in loamy alluvium. Slopes are 0 to 1 percent.

Lamo Variant soils are commonly adjacent to Alliance, Duroc, and Rosebud soils on the landscape. Alliance and Rosebud soils are well drained, have a mollic epipedon less than 20 inches thick, have more clay in the control section, and are higher on the landscape than Lamo Variant soils. In addition, Rosebud soils are moderately deep over weakly cemented sandstone bedrock. Duroc soils are well drained and are slightly higher in elevation.

Typical pedon of Lamo Variant loam, 0 to 1 percent slopes, 2,350 feet south and 500 feet west of the northeast corner of section 13, T. 27 N., R. 48 W.

Ap—0 to 5 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

A1—5 to 15 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine and medium platy structure; hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

A2—15 to 37 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; few fine distinct dark brown (7.5YR 4/4) mottles; weak fine and medium subangular blocky structure; hard, friable; neutral; gradual wavy boundary.

C—37 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The thickness of the solum and the thickness of the mollic epipedon range from 20 to 40 inches. The depth to free carbonates ranges from 0 to 12 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). It is typically loam, but the range includes very fine sandy loam. Reaction ranges from neutral through moderately alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 1 or 2 (dry or moist). It is typically very fine sandy loam, but the range includes loam and silt loam. Reaction is mildly alkaline or moderately alkaline.

Las Animas Series

The Las Animas series consists of deep, somewhat poorly drained soils on bottom lands and in a few alluvial swales. Permeability is moderately rapid. These soils formed in stratified alluvium. Slopes range from 0 to 2 percent.

Las Animas soils are commonly adjacent to Bankard, Janise, and Lisco soils on the landscape. Bankard soils have more sand in the control section, are better drained, and are slightly higher on the landscape than Las Animas soils. Janise soils have more clay and less fine sand in the control section and are very strongly affected by salinity and alkalinity. Lisco soils have a B horizon and are very strongly affected by alkalinity.

Typical pedon of Las Animas very fine sandy loam in an area of Las Animas-Lisco very fine sandy loams, 0 to 2 percent slopes, 2,350 feet north and 750 feet east of the southwest corner of section 10, T. 28 N., R. 52 W.

A—0 to 4 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—4 to 9 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C1—9 to 18 inches; light gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C2—18 to 29 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4) mottles; massive; soft, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C3—29 to 42 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 5/3) moist; many medium

prominent dark yellowish brown (10YR 3/4) mottles; massive; soft, very friable; slight effervescence; moderately alkaline; gradual smooth boundary.

C4—42 to 60 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; many medium prominent dark yellowish brown (10YR 3/4) mottles; single grained; loose; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 4 to 16 inches, and the depth to free carbonates ranges from 0 to 10 inches. The thickness of the ochric epipedon ranges from 4 to 8 inches.

The A horizon has value of 4 through 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes fine sandy loam and loamy very fine sand. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 6 through 8 (5 through 7, moist) and chroma of 2 or 3 (dry or moist). Above a depth of 40 inches it is typically very fine sandy loam and loamy very fine sand, but the range includes fine sandy loam. Below a depth of 40 inches the C horizon ranges from very fine sandy loam to sand. Reaction is mildly alkaline or moderately alkaline.

Lisco Series

The Lisco series consists of deep, somewhat poorly drained and poorly drained soils on bottom lands and in some alluvial swales. Permeability is moderately rapid. These soils are strongly and very strongly saline-alkali. They formed in calcareous, loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Lisco soils are similar to Janise soils and are commonly adjacent to Ipage, Janise, and Las Animas soils on the landscape. Janise soils have more clay and less fine sand in the control section than Lisco soils. Ipage soils have more sand in the control section, do not have saline-alkali characteristics in the solum, and are slightly higher on the landscape. Las Animas soils do not have a B horizon and do not have saline-alkali characteristics.

Typical pedon of Lisco very fine sandy loam, 0 to 2 percent slopes, 300 feet east and 500 feet north of the southwest corner of section 7, T. 24 N., R. 50 W.

A—0 to 2 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; strong effervescence; very strongly alkaline; abrupt smooth boundary.

E—2 to 5 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; violent effervescence; very strongly alkaline; abrupt smooth boundary.

Bw1—5 to 12 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; violent effervescence; very strongly alkaline; clear smooth boundary.

Bw2—12 to 16 inches; light brownish gray (10YR 6/2) loamy very fine sand, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; violent effervescence; very strongly alkaline; gradual smooth boundary.

C1—16 to 44 inches; light brownish gray (10YR 6/2) loamy very fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; very strongly alkaline; clear smooth boundary.

C2—44 to 52 inches; gray (10YR 6/1) loam, dark gray (10YR 4/1) moist; massive; hard, friable; violent effervescence; strongly alkaline; gradual smooth boundary.

C3—52 to 60 inches; light gray (10YR 7/1) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 10 to 20 inches, and the thickness of the ochric epipedon ranges from 2 to 8 inches. Free carbonates are in the upper 6 inches.

The A horizon has value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). Texture is typically very fine sandy loam, but the range includes fine sandy loam and loam. Reaction is moderately alkaline through very strongly alkaline. The Bw horizon has value of 5 through 7 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). Texture is typically very fine sandy loam and loamy very fine sand, but the range includes loam and fine sandy loam. Reaction is moderately alkaline through very strongly alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 1 through 3 (dry or moist). It is typically loam, very fine sandy loam, and loamy very fine sand, but the range includes fine sandy loam, loamy fine sand, and fine sand. Reaction is moderately alkaline through very strongly alkaline.

Manter Series

The Manter series consists of deep, well drained soils on uplands. Permeability is moderately rapid. These soils formed mainly in moderately coarse eolian material or outwash material weathered from sandstone. Slopes range from 0 to 6 percent.

Manter soils are similar to Jayem soils and are commonly adjacent to Alliance, Busher, Hemingford, and Satanta soils on the landscape. Jayem soils do not have an argillic horizon and have carbonates below a depth of

40 inches. Alliance, Hemingford, and Satanta soils have more silt and clay in the Bt horizon and the upper part of the C horizon and are slightly lower on the landscape than Manter soils. Busher soils are 40 to 60 inches deep to weakly cemented sandstone and do not have an argillic horizon.

Typical pedon of Manter fine sandy loam in an area of Manter-Satanta fine sandy loams, 3 to 6 percent slopes, 1,650 feet south and 1,650 feet east of the northwest corner of section 5, T. 27 N., R. 47 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

BA—7 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

Bt—12 to 27 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

C1—27 to 38 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse and fine subangular blocky structure; soft, very friable; mildly alkaline; gradual smooth boundary.

C2—38 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 36 inches, and the depth to free carbonates ranges from 18 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 19 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically fine sandy loam, but the range includes sandy loam. Reaction is slightly acid or neutral. The Bt horizon has value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically fine sandy loam, but in some pedons it is sandy loam. It averages between 9 and 18 percent clay. Reaction is neutral or mildly alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically fine sandy loam and loamy fine sand, but the range includes sandy loam and loamy sand. Reaction is mildly alkaline or moderately alkaline.

Marlake Series

The Marlake series consists of deep, very poorly drained, rapidly permeable soils on bottom lands along streams and in basins of the sandhills. These soils formed in eolian or alluvial material. Slopes are 0 to 1 percent.

Marlake soils are commonly adjacent to Hoffland, Ipage, and Lisco soils. Hoffland soils have a lower seasonal water table and are not stratified above a depth of 3 feet. Ipage soils are better drained than Marlake soils and are on the higher parts of the landscape. Lisco soils have more silt and clay in the control section and have saline-alkali characteristics.

Typical pedon of Marlake very fine sandy loam, 0 to 1 percent slopes, 2,350 feet north and 900 feet west of the southeast corner of section 1, T. 24 N., R. 47 W.

O—2 inches to 0; partially decayed organic material.

A1—0 to 9 inches; gray (10YR 5/1) very fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

A2—9 to 13 inches; gray (10YR 5/1) fine sandy loam, black (10YR 2/1) moist; stratified and mixed with light brownish gray (2.5Y 6/2) fine sandy loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; moderately alkaline; clear smooth boundary.

AC—13 to 20 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; stratified and mixed with gray (10YR 5/1) fine sand; few fine distinct yellowish brown (10YR 5/6) mottles; single grained; loose; mildly alkaline; clear smooth boundary.

C—20 to 60 inches; light gray (2.5Y 7/2) fine sand, light brownish gray (2.5Y 6/2) moist; single grained; loose; mildly alkaline.

The thickness of the solum ranges from 6 to 24 inches, and the depth to free carbonates ranges from 0 to 10 inches. The mollic epipedon ranges from 6 to 15 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). Texture is typically very fine sandy loam, but the range includes fine sandy loam and loamy fine sand. Reaction is neutral through moderately alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 1 or 2 (dry or moist). It is typically fine sand, but the range includes sand and loamy fine sand. Reaction is neutral or mildly alkaline.

McCook Series

The McCook series consists of deep, well drained, moderately permeable soils on bottom lands. These soils formed in weakly stratified, calcareous loamy alluvium. Slopes range from 0 to 2 percent.

McCook soils are similar to Bridget and Craft soils and are commonly adjacent to Duroc, Goshen, and Janise

soils on the landscape. Bridget soils are not stratified and are slightly higher on the landscape than McCook soils. Craft soils do not have a mollic epipedon. Duroc soils have a mollic epipedon thicker than 20 inches and have more clay in the control section. Goshen soils have more clay in the control section and are on stream terraces. Janise soils do not have a mollic epipedon, are not so well drained, have saline-alkali characteristics, and are slightly lower on the landscape.

Typical pedon of McCook loam, 0 to 2 percent slopes, 1,850 feet south and 350 feet west of the northeast corner of section 18, T. 25 N., R. 47 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—6 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium granular; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

AC—12 to 20 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

Ab—20 to 32 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; strong effervescence; moderately alkaline; gradual smooth boundary.

ACb—32 to 45 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; diffuse smooth boundary.

C—45 to 60 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 17 to 33 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to free carbonates is less than 10 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). Texture is typically loam, but the range includes silt loam and very fine sandy loam. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically loam, but in some pedons it is silt loam or very fine sandy loam. It averages less than 18 percent clay. A buried A horizon or thin, dark-colored strata are beneath the solum in most areas.

Norrest Series

The Norrest series consists of moderately deep, well drained soils on uplands. Permeability is moderately slow. These soils formed in loamy and clayey material weathered from calcareous clayey siltstone. Slopes range from 6 to 30 percent.

These Norrest soils do not have an argillic horizon and have less noncarbonate clay and less organic matter than is defined in the range for the Norrest series, but these differences do not alter the use or behavior of the soils.

Norrest soils are commonly adjacent to Canyon, Creighton, Imlay, and Rosebud soils on the landscape. Canyon soils have less clay in the control section than Norrest soils and are shallow over sandstone. Creighton soils are deep, have a mollic epipedon, and have less clay in the control section. Imlay soils are shallow over clayey siltstone and are on the slightly higher parts of the landscape. Rosebud soils have a mollic epipedon, have an argillic horizon, and are moderately deep over fine-grained sandstone.

Typical pedon of Norrest loam, 6 to 11 percent slopes, 2,300 feet south and 475 feet east of the northwest corner of section 21, T. 28 N., R. 50 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, friable; common fine fragments of sandstone; strong effervescence; mildly alkaline; clear wavy boundary.

Bw1—4 to 8 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, firm; common fine fragments of sandstone; violent effervescence; moderately alkaline; clear wavy boundary.

Bw2—8 to 21 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to weak fine subangular blocky; very hard, firm; common fine fragments of sandstone; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—21 to 60 inches; very pale brown (10YR 7/3) clayey siltstone; strong effervescence.

The thickness of the solum ranges from 20 to 36 inches, and the depth to free carbonates ranges from 0 to 5 inches. The thickness of the ochric epipedon ranges from 4 to 8 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

The A horizon has value of 4 through 6 (3 through 5, moist) and chroma of 1 or 2 (dry or moist). It is typically loam, but the range includes silt loam and clay loam. The Bw horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically

clay loam, but in some pedons it is silty clay loam. It averages between 28 to 35 percent noncarbonate clay. Some pedons have a Bk horizon that is similar in texture to the B horizon. Clayey siltstone is at a depth of 20 to 40 inches.

Oglala Series

The Oglala series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy residuum of weakly cemented, fine-grained sandstone. Slopes range from 3 to 30 percent.

These Oglala soils have more fine and coarse sand than is defined in the range for the Oglala series, but this difference does not alter the use or behavior of the soils.

Oglala soils are similar to Bridget and Creighton soils and are commonly adjacent to Alliance, Bridget, Canyon, Craft, and Creighton soils on the landscape. Alliance soils have more clay in the control section, have a well developed B horizon, and generally are slightly higher on the landscape than Oglala soils. Bridget soils are more than 60 inches deep to bedrock and are on slightly lower parts of the landscape. Canyon soils are shallow over bedrock, do not have a mollic epipedon, and are higher on the landscape. Craft soils are stratified, do not have a mollic epipedon, and are on bottom lands. Creighton soils have a B horizon and are more than 60 inches deep to bedrock.

Typical pedon of Oglala very fine sandy loam in an area of Oglala-Canyon very fine sandy loams, 3 to 9 percent slopes, 100 feet south and 1,550 feet west of the northeast corner of section 17, T. 25 N., R. 48 W.

A—0 to 8 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

AC—8 to 22 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; moderately alkaline; gradual smooth boundary.

C—22 to 53 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; few fine fragments of sandstone; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—53 to 60 inches; white (10YR 8/2) weakly cemented fine-grained sandstone; strong effervescence.

The thickness of the solum ranges from 15 to 30 inches, and the depth to free carbonates ranges from 15 to 36 inches. The thickness of the mollic epipedon ranges from 7 to 15 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loam. Reaction is neutral or mildly alkaline. The C horizon has value of 6 through 8 (5 or 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes fine sandy loam and loamy very fine sand. Reaction is mildly alkaline or moderately alkaline. Weakly cemented, limy sandstone is at a depth of 40 to 60 inches.

Richfield Series

The Richfield series consists of deep, well drained soils on low-lying uplands. Permeability is moderately slow. These soils formed in calcareous loess. Slopes are 0 to 1 percent.

Richfield soils are similar to Keith soils and are commonly adjacent to Duroc and Keith soils on the landscape. Keith soils have less clay in the Bt horizon and are higher on the landscape than Richfield soils. Duroc soils have a mollic epipedon thicker than 20 inches, do not have a Bt horizon, and are slightly lower on the landscape.

Typical pedon of Richfield loam, 0 to 1 percent slopes, 2,100 feet south and 200 feet east of the northwest corner of section 35, T. 25 N., R. 47 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

BA—8 to 11 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, firm; mildly alkaline; clear smooth boundary.

Bt—11 to 18 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; mildly alkaline; clear smooth boundary.

BCk—18 to 26 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, firm; strong effervescence; moderately alkaline; gradual smooth boundary.

Ck—26 to 34 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C—34 to 60 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches, and the depth to free carbonates ranges from 10 to 18 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically loam, but the range includes silt loam and very fine sandy loam.

Reaction is neutral or mildly alkaline. The Bt horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is silty clay loam, and it averages between 35 and 40 percent clay. Reaction is neutral or mildly alkaline. The C horizon has value of 6 through 8 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). Reaction is moderately alkaline or strongly alkaline.

Rosebud Series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy calcareous material weathered from sandstone (fig. 15). Slopes range from 0 to 30 percent.

Rosebud soils are similar to Hemingford soils and are commonly adjacent to Alliance, Canyon, Creighton, Duroc, and Hemingford soils on the landscape. Alliance and Hemingford soils are 40 to 60 inches deep to soft sandstone. Canyon soils are 8 to 20 inches deep to sandstone and do not have a Bt horizon. Creighton soils do not have an argillic horizon, have more sand in the control section than Rosebud soils, and are 60 inches deep or deeper to sandstone. Duroc soils are deep, have a mollic epipedon over 20 inches thick, and are on slightly lower parts of the landscape.

Typical pedon of Rosebud loam, 1 to 3 percent slopes, 1,150 feet west and 150 feet south of the northeast corner of section 34, T. 28 N., R. 51 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

Bt—7 to 19 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; neutral; clear smooth boundary.

BC—19 to 24 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; mildly alkaline; gradual smooth boundary.

Ck—24 to 35 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; many fine fragments of sandstone; violent effervescence; moderately alkaline; gradual smooth boundary.

Cr—35 to 60 inches; white (10YR 8/2) weakly consolidated sandstone; violent effervescence.

The thickness of the solum ranges from 12 to 26 inches, and the depth to free carbonates ranges from 10 to 30 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). It is typically loam, but

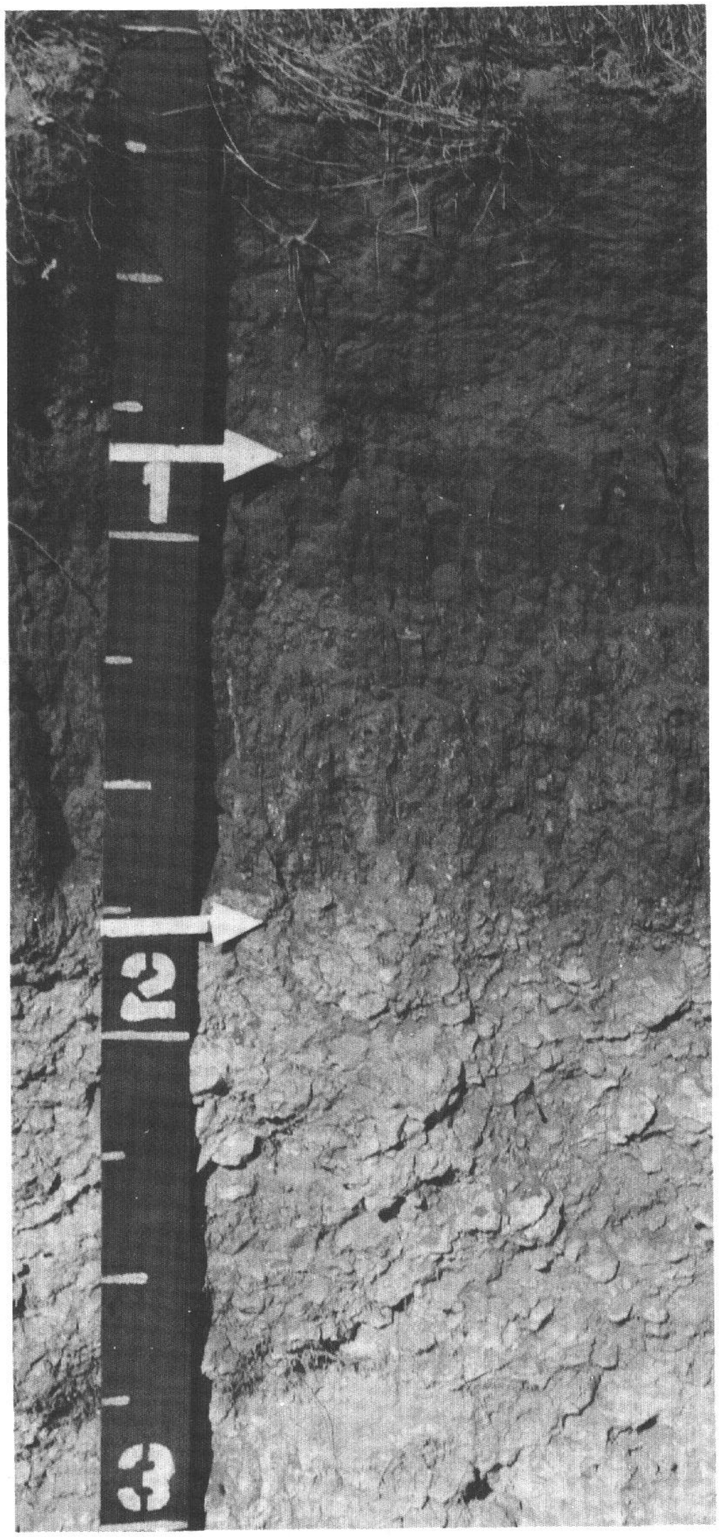

Figure 15.—Profile of Rosebud loam, a moderately deep, well drained soil. Soft, weakly cemented sandstone is at a depth of 22 inches. The depth is marked in feet.

the range includes very fine sandy loam. Reaction is neutral or mildly alkaline. The Bt horizon has value of 4 through 6 (3 or 4, moist) and chroma of 2 or 3 (dry or moist). It is typically clay loam, but in some pedons it is loam. It averages between 23 and 35 percent clay. Reaction is neutral or mildly alkaline. The C horizon has value of 6 or 7 (5 or 6, moist) and chroma of 2 or 3 (dry or moist). It is typically very fine sandy loam, but the range includes loam, sandy clay loam, and sandy loam. Reaction is mildly alkaline or moderately alkaline. Weakly cemented, limy sandstone is at a depth of 20 to 40 inches.

Sarben Series

The Sarben series consists of deep, well drained soils on uplands. Permeability is moderately rapid. These soils formed in mixed loamy and sandy eolian material weathered from sandstone. Slopes range from 0 to 9 percent.

Sarben soils are similar to Busher soils and are commonly adjacent to Busher, Creighton, Tassel, and Valent soils on the landscape. Busher soils have a cambic horizon and a mollic epipedon and are 40 to 60 inches deep to weakly cemented sandstone. Creighton soils have a mollic epipedon and a Bw horizon. Tassel soils are less than 20 inches deep to sandstone bedrock. Valent soils have more sand in the control section and are on slightly higher parts of the landscape than Sarben soils.

Typical pedon of Sarben loamy very fine sand in an area of Sarben-Busher loamy very fine sands, 3 to 9 percent slopes, 200 feet west and 400 feet north of the southeast corner of section 18, T. 26 N., R. 52 W.

A—0 to 3 inches; grayish brown (10YR 5/2) loamy very fine sand, dark brown (10YR 3/3) moist; weak very fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

AC—3 to 12 inches; grayish brown (10YR 5/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak fine subangular blocky; soft, very friable; neutral; clear smooth boundary.

C1—12 to 25 inches; light brownish gray (10YR 6/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak fine and coarse subangular blocky structure; soft, very friable; moderately alkaline; gradual smooth boundary.

C2—25 to 36 inches; light brownish gray (10YR 6/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; moderately alkaline; clear wavy boundary.

C3—36 to 44 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; violent effervescence; moderately alkaline; clear wavy boundary.

C4—44 to 60 inches; light gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) moist; massive; loose, very friable; few fine fragments of sandstone; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 22 inches, and the depth to free carbonates ranges from 26 to 60 inches. The thickness of the ochric epipedon ranges from 2 to 6 inches.

The A horizon has value of 4 through 6 (3 or 4, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy very fine sand, but the range includes loamy fine sand and very fine sandy loam. The C horizon has value of 5 through 8 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy very fine sand and very fine sandy loam, but the range includes fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

Satanta Series

The Satanta series consists of deep, well drained, moderately permeable soils on uplands and stream terraces. These soils formed in loamy eolian material, loamy alluvium, or in a mixture of both materials. Slopes range from 0 to 9 percent.

Satanta soils are similar to Hemingford soils and are commonly adjacent to Creighton, Hemingford, Jayem, Keith, and Manter soils on the landscape. Hemingford soils are 40 to 60 inches deep to fine-grained sandstone, have more clay in the control section, and are slightly lower on the landscape than Satanta soils. Creighton soils have more sand and less clay in the control section and are slightly lower on the landscape. Jayem soils have a cambic horizon, have more sand and less clay in the control section, and are slightly higher on the landscape. Keith soils have less sand and more clay in the subsoil and are slightly lower on the landscape. Manter soils have less clay and more sand in the subsoil.

Typical pedon of Satanta fine sandy loam, 0 to 3 percent slopes, 225 feet east and 300 feet north of the southwest corner of section 20, T. 25 N., R. 47 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

BA—7 to 13 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; clear smooth boundary.

Bt—13 to 24 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear smooth boundary.

BCk—24 to 31 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; violent effervescence; mildly alkaline; gradual smooth boundary.
C1—31 to 46 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few lime concretions; violent effervescence; mildly alkaline; gradual smooth boundary.
C2—46 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few lime concretions; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches. The depth to free carbonates ranges from 15 to 36 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3 (dry or moist). Texture is typically fine sandy loam, but the range includes very fine sandy loam. Reaction is slightly acid through mildly alkaline. The Bt horizon has value of 4 through 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). Texture is typically loam, but the range includes sandy clay loam and clay loam. The Bt horizon averages between 18 and 28 percent clay. Reaction ranges from neutral through moderately alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically loam and very fine sandy loam, but the range includes fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

Scott Variant

The Scott Variant consists of deep, very poorly drained soils in depressions of uplands and stream terraces. Permeability is very slow. These soils formed in loess that is underlain by material weathered from sandstone. Slopes are 0 to 1 percent.

Scott Variant soils are commonly adjacent to Alliance, Duroc, Keith, and Satanta soils on the landscape. Alliance, Keith, and Satanta soils are well drained, have less clay in the Bt horizon, and are higher on the landscape than Scott Variant soils. In addition, Keith and Satanta soils are 60 inches deep or deeper to sandstone. Duroc soils do not have a B horizon, have less clay in the control section, are well drained, and are slightly higher on the landscape.

Typical pedon of Scott Variant loam, 0 to 1 percent slopes, 600 feet north and 2,300 feet east of the southwest corner of section 32, T. 28 N., R. 47 W.

Ap—0 to 6 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak coarse platy structure; hard, friable; medium acid; abrupt smooth boundary.
E—6 to 9 inches; light gray (10YR 6/1) loam, dark gray (10YR 4/1) moist; weak coarse and medium subangular blocky structure; hard, friable; medium acid; clear smooth boundary.
Bt—9 to 19 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; slightly acid; clear smooth boundary.
BC—19 to 22 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; violent effervescence; mildly alkaline; clear smooth boundary.
C—22 to 41 inches; light gray (2.5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) moist; few fine distinct dark yellowish brown (10YR 4/4) mottles; massive; slightly hard, friable; violent effervescence; mildly alkaline; gradual smooth boundary.
Cr—41 to 60 inches; light gray (2.5Y 7/2) weakly cemented sandstone; violent effervescence.

The thickness of the solum and the thickness of the mollic epipedon range from 18 to 45 inches. The depth to free carbonates ranges from 15 to 48 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). It is typically loam, but the range includes silt loam and very fine sandy loam. Reaction is medium acid through neutral. The Bt horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). Texture is typically clay, but the range includes silty clay and silty clay loam. This horizon averages between 34 and 50 percent clay. Reaction is slightly acid through mildly alkaline. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). Texture is typically silt loam, but the range includes loam and very fine sandy loam. Reaction is mildly alkaline or moderately alkaline. Weakly cemented, limy sandstone is at a depth of 40 to 60 inches.

Tassel Series

The Tassel series consists of shallow, well drained and somewhat excessively drained soils on uplands. Permeability is moderately rapid. These soils formed in calcareous material weathered from underlying fine-grained sandstone. Slopes range from 0 to 60 percent.

Tassel soils are similar to Canyon soils and are commonly adjacent to Busher, Imlay, Sarben, and Valent soils on the landscape. Canyon soils have less sand and more clay in the control section than Tassel soils. Busher soils are more than 40 inches deep to bedrock, have a mollic epipedon, and are generally slightly lower on the landscape. Imlay soils have more clay and less sand in the control section, are shallow to clayey siltstone, and are slightly higher on the landscape. Sarben soils are 60 inches deep or deeper to bedrock

and are generally lower on the landscape. Valent soils are deep and have more sand in the control section.

Typical pedon of Tassel loamy very fine sand, 3 to 30 percent slopes, 1,850 feet east and 200 feet north of the southwest corner of section 23, T. 28 N., R. 52 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable; slight effervescence; mildly alkaline; clear smooth boundary.

C—7 to 18 inches; light gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; many fine fragments of soft sandstone; violent effervescence; mildly alkaline; clear wavy boundary.

Cr—18 to 60 inches; white (10YR 8/2) weakly cemented sandstone; violent effervescence.

The thickness of the ochric epipedon ranges from 3 to 8 inches. The depth to free carbonates ranges from 0 to 3 inches, and the depth to bedrock ranges from 6 to 20 inches.

The A horizon has value of 4 through 7 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy very fine sand, but the range includes fine sandy loam and loamy fine sand. Reaction is mildly alkaline or moderately alkaline. The C horizon has value of 6 through 8 (4 through 7, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy very fine sand, but the range includes fine sandy loam and loamy fine sand. Reaction is mildly alkaline or moderately alkaline.

Valent Series

The Valent series consists of deep, excessively drained, rapidly permeable soils on uplands. These soils formed in eolian sand (fig. 16). Slopes range from 0 to 17 percent.

Valent soils are similar to Dailey and Valentine soils and are commonly adjacent to Busher, Dailey, Ipage, Sarben, and Tassel soils on the landscape. Dailey soils have a mollic epipedon and are slightly lower on the landscape than Valent soils. Valentine soils occur under a slightly more humid climate. Busher soils have a mollic epipedon, are 40 to 60 inches deep to bedrock, and are on slightly lower parts of the landscape. Ipage soils are moderately well drained, are mottled above a depth of 40 inches, and are on lower parts of the landscape. Sarben soils contain more clay in the subsoil. Tassel soils are shallow over sandstone bedrock and are slightly finer textured.

Typical pedon of Valent fine sand, 3 to 9 percent slopes, 150 feet north and 1,300 feet east of the southwest corner of section 17, T. 24 N., R. 49 W.

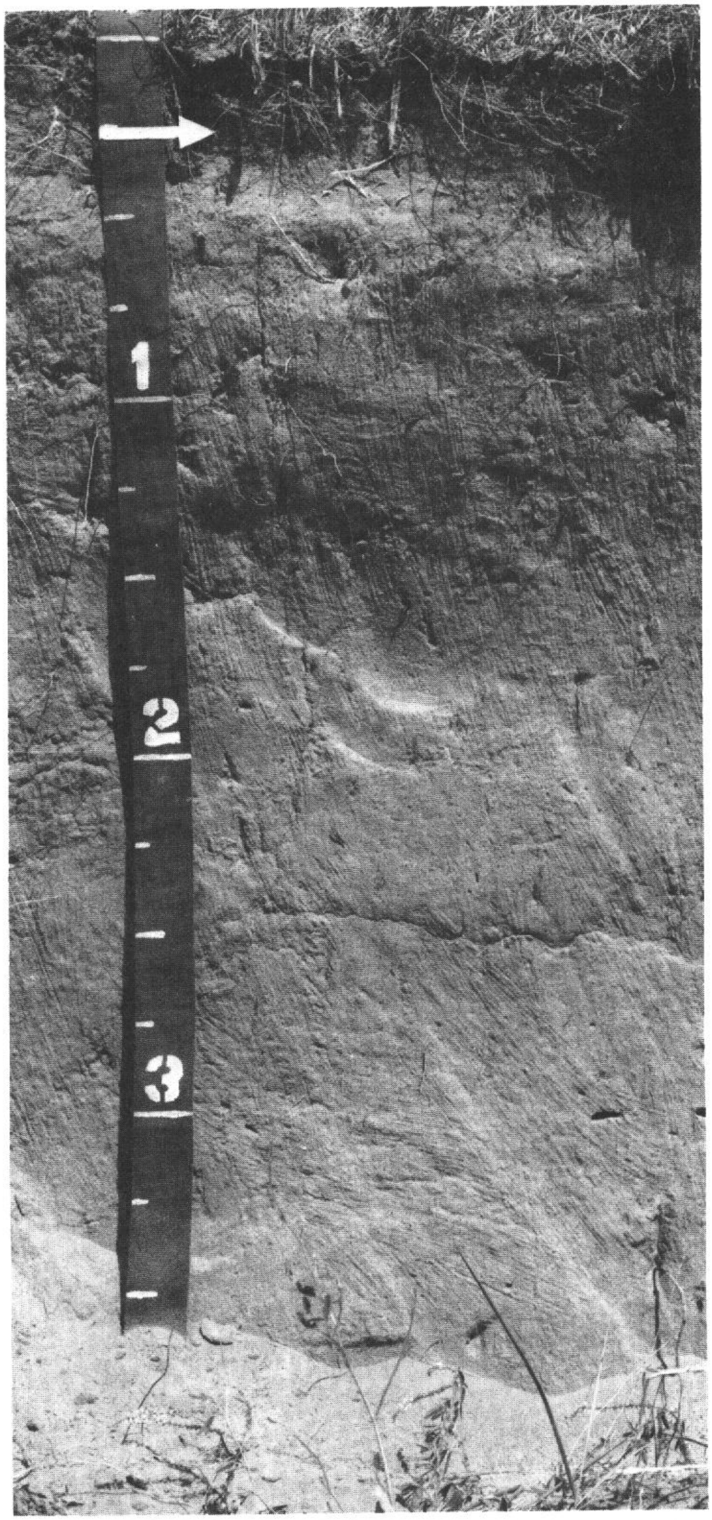

Figure 16.—Profile of Valent fine sand, a deep, excessively drained soil that has little profile development and a thin surface layer. The depth is marked in feet.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose; slightly acid; abrupt smooth boundary.

C—4 to 60 inches; brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; neutral.

The thickness of the ochric epipedon ranges from 3 to 10 inches. The depth to free carbonates ranges from 40 to more than 60 inches.

The A horizon has value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3 (dry or moist). It is loamy fine sand or fine sand. Reaction is slightly acid or neutral. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist). It is typically fine sand, but the range includes loamy fine sand. Reaction is neutral or mildly alkaline.

Valentine Series

The Valentine series consists of deep, excessively drained, rapidly permeable soils on sandhills. These soils formed in eolian sand. Slopes range from 3 to 60 percent.

Valentine soils are similar to Dailey and Valent soils and are commonly adjacent to Dailey, Hoffland, and Ipage soils on the landscape. Dailey soils have a mollic epipedon and are lower on the landscape than Valentine soils. Hoffland soils are very poorly drained and are lower on the landscape. Valent soils occur where the climate is drier. Ipage soils are moderately well drained, are mottled above a depth of 40 inches, and are lower on the landscape.

Typical pedon of Valentine fine sand, 9 to 17 percent slopes, 2,600 feet south and 100 feet east of the northwest corner of section 1, T. 24 N., R. 47 W.

A—0 to 3 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; loose; slightly acid; abrupt smooth boundary.

AC—3 to 7 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak very fine granular; loose; slightly acid; clear smooth boundary.

C—7 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; slightly acid.

The thickness of the solum ranges from 5 to 15 inches. Free carbonates are below a depth of 60 inches. The ochric epipedon ranges from 2 to 9 inches in thickness. Reaction is slightly acid or neutral throughout the profile.

The A horizon has value of 4 through 6 (3 through 5, moist) and chroma of 2 (dry or moist). The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3 (dry or moist).

Vetal Series

The Vetal series consists of deep, well drained soils on foot slopes and in upland swales. Permeability is moderately rapid. These soils formed in alluvium and colluvium that have been reworked by wind in some areas. Slopes range from 0 to 6 percent.

Vetal soils are similar to Busher, Creighton, and Jayem soils and are commonly adjacent to Bridget, Busher, Creighton, Jayem, and Satanta soils on the landscape. Bridget soils have a mollic epipedon less than 20 inches thick and have free carbonates above a depth of 15 inches. Busher soils have a mollic epipedon less than 20 inches thick, are 40 to 60 inches deep to sandstone bedrock, and are higher on the landscape than Vetal soils. Creighton soils have textures that are typically very fine sandy loam, have a mollic epipedon less than 20 inches thick, have free carbonates at a depth of less than 20 inches, and are generally higher on the landscape. Jayem soils have a mollic epipedon less than 20 inches thick and are higher on the landscape. Satanta soils have a mollic epipedon less than 20 inches thick, have more clay in the control section, and are higher on the landscape.

Typical pedon of Vetal fine sandy loam, 0 to 3 percent slopes, 2,600 feet south and 475 feet east of the northwest corner of section 5, T. 28 N., R. 48 W.

A1—0 to 10 inches; dark gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; weak very fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A2—10 to 24 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak very fine granular; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—24 to 36 inches; grayish brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine granular; soft, very friable; mildly alkaline; clear smooth boundary.

C—36 to 60 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; soft, very friable; few fine fragments of soft sandstone; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 54 inches. Free carbonates are below a depth of 30 inches. The thickness of the mollic epipedon ranges from 20 to 48 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2 (dry or moist). It is typically fine sandy

loam, but the range includes very fine sandy loam and loamy fine sand. Reaction is neutral or mildly alkaline. The C horizon has value of 5 through 7 (4 or 5, moist) and chroma of 2 or 3 (dry or moist). It is typically loamy fine sand, but the range includes very fine sandy loam, fine sandy loam, loamy very fine sand, and fine sand. Reaction ranges from neutral through moderately alkaline.

Formation of the Soils

This section tells how the factors of soil formation have affected the development of soils in Box Butte County.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agents. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mass in which the soil forms. It determines the mineralogical and chemical composition of the soil. In Box Butte County, the soils formed in six kinds of parent material—loess, material weathered from sandstone, eolian sand, alluvium, mixed alluvium and colluvium, and material weathered from clayey siltstone.

Loess is one of the more extensive parent materials in the county. This windblown material is believed to have been blown out of old river and stream valleys. It is a brownish and yellowish deposit ranging in thickness from 1 foot to about 8 feet. The Keith and Richfield soils are examples of soils that formed from loess and that generally have good horizon development.

Material weathered from sandstone formations is a major parent material of the soils in the county. The soils formed in place or they formed in material that was locally reworked and transported by wind. These deposits range in thickness from a few inches to several feet. Except for a slightly darkened surface layer, most soils that formed in this material have weakly expressed horizons. The Busher, Creighton, and Tassel soils formed in this material. Most of the material in the Sarben and Jayem soils also weathered from sandstone, but it has been locally reworked by the wind and possibly contains material from other sources.

Eolian sand is a wind deposited material consisting mainly of quartz and feldspar minerals. The thickness of the sand ranges from 1 foot to more than 75 feet on some of the larger sandhills. Except for a somewhat darkened layer at the surface, soils formed in eolian sand show little horizon development. The Dailey, Valent, and Valentine soils formed in eolian sand.

Alluvium is material that has been deposited by moving water. It consists of sand, silt, and clay washed from the higher areas and deposited on bottom lands and stream terraces of the major streams and adjacent drainageways. The deposits range in thickness from a few feet to more than 20 feet. They are young, and, except for the darkened surface layer, they generally have few clearly expressed horizons. The Bankard, Craft, and McCook soils formed in alluvium. Janise and Lisco soils have a weakly developed subsoil and vary in texture according to the alluvium in which they formed.

Alluvium and colluvium have been deposited by the combined forces of gravity and water. They consist of material that has been moved down from the higher areas and redeposited on foot slopes at the base of hills and along small drainageways or swales. These deposits are generally less than 8 feet thick. Except for the darkened surface layer, soils formed in this material have only weakly expressed horizons. The Bridget, Duroc, and Vetal soils formed in this material.

Material weathered from clayey siltstone of the Box Butte formation is a minor kind of parent material in the county. Some of this material has been reworked by wind and water. The deposit ranges in thickness from a few inches to about 3 feet. Except where the slope is

steep or very steep, soils formed in this material generally show reasonably definite horizons. Norrest and Imlay soils formed in this material.

In many areas of the county, soils formed in a mixture of different parent materials or where young material was deposited over older material. Examples of soils formed in more than one type of parent material are Alliance soils, which formed in loess over material weathered from sandstone; Hemingford soils, which formed in loess over material reworked from clayey siltstone and sandstone; and Satanta soils, which formed in loess, alluvium, or a combination of both.

Climate

Climate influences vegetation, activity of soil micro-organisms, and the physical condition of the soil. It directly affects weathering and soil formation through rainfall, changes in temperature, and the effects of wind. The climate of Box Butte County is semiarid and continental. The average annual precipitation is about 15 inches, and the average annual temperature is 46 degrees F. The average growing season is about 135 days. The prevailing wind is from the east-southeast from May to September and from the west or west-northwest during the remainder of the year.

Rainwater moves through the soil, carrying clay colloids downward from the surface and leaching soluble salts downward in the profile. The surface flow of water caused by heavy rains continuously detaches, mixes, transports, and redeposits unconsolidated materials of many kinds. The alluvial soils, such as McCook and Craft, are examples of soils that formed in sediment deposited by water.

The amount of moisture and the prevailing temperature during the growing season affect the amount of vegetation, which is the principal source of organic matter. These same factors affect the chemical processes and activities of micro-organisms that convert organic matter to humus. Alternate freezing and thawing and wetting and drying speed the mechanical and chemical weathering processes and also improve the physical condition of the soil.

Wind, another important climatic factor, transfers soil material from one place to another. It also mixes, sorts, thins, or thickens the surface layer, causing changes in the physical properties of this horizon. Hot winds in summer have a drying effect on the soil. The deposits of loess and sand in the county are examples of the importance of wind as a soil-forming agent. Both the gently sloping landscape of the loamy Keith soils and the hummocks and dunes of the sandy Valentine soils can be attributed to wind activity.

As a result of disturbance of the soils by human activities, hard rains from intense thunderstorms have eroded the surface layer and lowered the organic matter content and fertility of many soils in the county. The wind has eroded many of the unprotected surfaces, especially on the moderately coarse and coarse soils, and has removed part or all of the organic matter.

Plant and Animal Life

After the weathering and deposition of parent material, bacteria, fungi, amoebas, and other simple forms of plant and animal life invade the soil. After a time, more complex forms of life begin to develop. Plants and animals living on and in the soil produce organic matter. This influences the physical and chemical properties of the soil. The other four soil-forming factors affect the kind and amount of plant and animal life that lives on or in the soil.

The soils of Box Butte County formed under a short grass prairie type of vegetation. The decomposition of plants and their roots provided the soil with organic matter. The fibrous root system of the grasses penetrates the soil and helps form a friable surface layer and a permeable subsoil. These features enhance the flow of water into the soil and increase soil porosity. An increase in porosity allows greater movement of air in the soil and stimulates the action of bacteria and burrowing animals. In the sandhills area, grasses are a prime factor in stabilization of the dunes.

When plants decay, micro-organisms act upon the plant litter to form humus, a source of nutrients. Some bacteria take in nitrogen from the air and use it for their own growth. When these bacteria die, the nitrogen becomes available to plants. Insects, earthworms, and small burrowing animals influence soil formation by mixing the organic and mineral parts of the soil together. The burrowing action of these animals stirs the soil and mixes in fresh nutrients, which hasten the formation of organic matter. In areas of poorly drained soils, which are poorly aerated, the micro-organisms and earthworms act slowly because of a low supply of air. Consequently, plant litter decays more slowly than it does on the better drained soils.

The accumulation of organic matter gradually darkens the surface layer of the soils. The Duroc and Vetal soils have a thick, dark surface layer, and the Valent, Valentine, Lisco, and Norrest soils have a thin, dark surface layer.

Human activities have a major effect on soil formation. Because of cropping sequences, drainage systems, irrigation, and summer fallow, the relationships among soil, water, and erosion that existed for several thousand years have changed. Removing the grass cover has exposed the fertile surface layer to erosion. Drainage systems have increased chemical activity and weathering in poorly drained soils. Irrigation and summer fallow have increased the moisture supply and also the rates of chemical weathering and water movement.

Relief

Relief, or lay of the land, influences soil formation mainly through its effect on drainage, runoff, and vegetative growth. The degree of slope, shape of the surface, and permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soils. Internal drainage and availability of moisture are important factors in forming soil horizons.

The nearly level and gently sloping soils on uplands have stronger development and more distinct horizons than the steeper soils. They absorb more moisture and have less runoff, and water percolates deeper into the profile. Consequently, more leaching of lime, plant nutrients, and clay particles occur in these soils, and well developed and distinct horizons form. The nearly level and gently sloping Keith and Alliance soils have fairly well developed profiles.

On steep slopes where runoff is rapid and little moisture penetrates the soil, development of the soil is slower than on the gentler slopes. Erosion removes the surface soil almost as fast as it forms. Lime and other elements are not leached so deeply. Because the soils on ridges and hilltops are more exposed to air currents than those in the lower areas, they are more susceptible to loss of moisture by evaporation. In Box Butte County, the steep Tassel soils have little profile development other than a slightly darkened, thin surface layer.

In upland depressions, runoff is slow and the soils receive runoff from the higher areas. Because of the extra moisture, these soils have a thick, dark surface layer and good horizon development. Scott Variant is an example.

Soils on bottom lands have very little relief, but their position on the landscape has an influence on soil development in the young parent material. Some of these soils have a high water table that affects decay of organic matter, soil temperature, and alkalinity. Other bottom land soils are subject to flooding and to continuous deposition of sediment. All of these influences have an effect on the kind and amount of vegetation that grows and on soil development. The McCook and Craft soils are well drained bottom land soils. The Lisco soils are bottom land soils affected by alkalinity and a high water table.

Soils on the sandhills are not affected so much by slope, runoff, and internal drainage as they are by erosion and the resistance of the sandy material to chemical weathering. The Valentine soils are an example.

Time

Time is needed for soil formation. The length of time needed depends on the influence of the other four soil-forming processes, especially parent material.

Immature soils do not have well defined horizons because they have been exposed to soil forming factors for only a short time. The Craft soils on bottom land show little development because they have been in place only a short time and are subject to additions of soil material by floodwater. The addition of soil sediments with each flood is unfavorable for soil-forming processes. The Valent and Valentine soils are other examples of immature soils. The eolian material in which they formed has only been in place a short time, and chemical weathering has been slow.

Older, immature soils have a darkened surface layer but do not have a well developed subsoil. The Bridget soil is an example of this age of soil. It developed in alluvial-colluvial material at the base of hills and has been in place a fairly long time.

Mature soils have well developed and well defined horizons. These soils have parent material which has been in place long enough for climate, relief, and plant and animal life to alter it. The Keith and Hemingford soils are examples of soils that have been in place a long time. They have a well developed subsoil. Mature soils have reached an equilibrium with their environment.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compact layers to depths below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected

scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The total thickness of soil material over bedrock is given in the following classes: *very shallow,* 0 to 10 inches; *shallow,* 10 to 20 inches; *moderately deep,* 20 to 40 inches; and *deep,* more than 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November-May, for example means that flooding can occur during the period November through May. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal. Refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of another horizon.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C

horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

R layer.—Hard bedrock beneath the soil. The bedrock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks that are separated by low sage and have sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon,

hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic matter content. The amount of organic matter in soil material. The classes used in this survey are *very low*, less than 0.5 percent; *low*, 0.5 to 1.0 percent; *moderately low*, 1.0 to 2.0 percent; *moderate*, 2.0 to 4.0 percent; and *high*, 4.0 to 8.0 percent.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing range and pasture in a manner that will maintain adequate cover for soil protection and maintain or improve the quality and quantity of desirable vegetation.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is

called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, the classes of slope are:

Nearly level	0 to 1 percent and 0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Strongly sloping	6 to 9 percent and 6 to 11 percent
Moderately steep	9 to 17 percent
Steep	11 to 30 percent and 9 to 30 percent
Very steep	30 to 60 percent

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. Includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of new series is not justified.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Wind stripcropping. Stripcropping at right angles to the prevailing wind.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-77 at Alliance, Nebraska]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	35.8	9.6	22.7	61	-22	13	0.32	0.05	0.53	1	5.5
February	41.0	14.9	28.0	70	-16	25	.25	.07	.39	1	5.3
March	45.1	19.9	32.5	75	-9	57	.69	.22	1.05	3	7.9
April	57.1	30.5	43.8	84	5	174	1.58	.87	2.15	5	5.1
May	68.3	41.6	54.9	91	25	462	2.87	1.37	4.08	7	.2
June	78.9	51.1	65.0	101	34	750	2.88	1.65	3.89	7	.0
July	87.2	56.8	72.0	103	43	992	2.13	.89	3.12	5	.0
August	85.8	54.7	70.3	101	40	939	1.74	.68	2.59	4	.0
September	75.2	43.8	59.5	96	24	585	1.40	.18	2.29	4	.1
October	64.2	33.0	48.6	87	14	286	.69	.22	1.07	2	1.3
November	47.9	20.9	34.4	73	-5	39	.32	.11	.48	1	4.6
December	39.2	13.4	26.3	65	-16	13	.25	.07	.39	1	4.9
Yearly:	60.5	32.5	46.5	103	-25	4,335	15.12	12.01	18.07	41	34.9

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-77 at Alliance, Nebraska]

Probability	Temperature: 24° F or lower	Temperature: 28° F or lower	Temperature: 32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 16	May 20	May 31
2 years in 10 later than--	May 5	May 14	May 26
5 years in 10 later than--	April 25	May 3	May 15
First freezing temperature in fall:			
1 year in 10 earlier than--	September 26	September 16	September 9
2 years in 10 earlier than--	October 1	September 22	September 14
5 years in 10 earlier than--	October 12	October 3	September 23

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-77 at Alliance, Nebraska]

Probability	Length of growing season if daily minimum temperature is --: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	147	126	107
8 years in 10	155	135	115
5 years in 10	169	152	130
2 years in 10	184	169	145
1 year in 10	191	177	152

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ac	Alliance loam, 0 to 1 percent slopes	29,500	4.4
AcB	Alliance loam, 1 to 3 percent slopes	60,900	9.0
AcC	Alliance loam, 3 to 6 percent slopes	7,000	1.0
ArB	Alliance-Rosebud loams, 1 to 3 percent slopes	13,000	1.9
ArC	Alliance-Rosebud loams, 3 to 6 percent slopes	17,700	2.6
ArD	Alliance-Rosebud loams, 6 to 11 percent slopes	3,450	0.5
Ba	Bankard fine sand, 0 to 2 percent slopes	278	*
BbB	Bankard very fine sandy loam, 0 to 3 percent slopes	630	0.1
Br	Bridget very fine sandy loam, 0 to 1 percent slopes	1,550	0.2
BrB	Bridget very fine sandy loam, 1 to 3 percent slopes	4,050	0.6
BrC	Bridget very fine sandy loam, 3 to 6 percent slopes	1,090	0.2
BuB	Busher-Jayem loamy very fine sands, 0 to 3 percent slopes	9,800	1.4
BuC	Busher-Jayem loamy very fine sands, 3 to 6 percent slopes	12,500	1.8
BuD	Busher-Jayem loamy very fine sands, 6 to 9 percent slopes	6,200	0.9
BvC	Busher-Tassel loamy very fine sands, 0 to 6 percent slopes	4,400	0.6
BvF	Busher-Tassel loamy very fine sands, 6 to 30 percent slopes	24,700	3.6
CaF	Canyon very fine sandy loam, 3 to 30 percent slopes	2,050	0.3
CbB	Craft very fine sandy loam, 0 to 3 percent slopes	3,550	0.5
Ce	Creighton very fine sandy loam, 0 to 1 percent slopes	2,250	0.3
CeB	Creighton very fine sandy loam, 1 to 3 percent slopes	28,950	4.3
CeC	Creighton very fine sandy loam, 3 to 6 percent slopes	20,250	3.0
CeD	Creighton very fine sandy loam, 6 to 11 percent slopes	2,650	0.4
CnD	Creighton-Norrest complex, 6 to 11 percent slopes	2,550	0.4
CnF	Creighton-Norrest complex, 11 to 30 percent slopes	2,000	0.3
DaB	Dailey loamy sand, 0 to 3 percent slopes	15,200	2.2
DaD	Dailey loamy sand, 3 to 9 percent slopes	7,100	1.0
DrB	Duroc loam, 1 to 3 percent slopes	13,400	2.0
Du	Duroc loam, occasionally flooded, 0 to 2 percent slopes	14,200	2.1
Go	Goshen loam, 0 to 1 percent slopes	2,550	0.4
Hm	Hemingford loam, 0 to 1 percent slopes	4,100	0.6
HmB	Hemingford loam, 1 to 3 percent slopes	4,200	0.6
HmC	Hemingford loam, 3 to 6 percent slopes	3,500	0.5
Ho	Hoffland fine sandy loam, wet, 0 to 1 percent slopes	450	0.1
ImG	Imlay-Rock outcrop complex, 11 to 60 percent slopes	3,100	0.5
IpB	Ipage loamy fine sand, alkali substratum, 0 to 3 percent slopes	5,100	0.7
JaB	Janise loamy fine sand, overblown, 0 to 3 percent slopes	2,100	0.3
JcB	Janise loamy fine sand, drained, overblown, 0 to 3 percent slopes	6,500	1.0
Jn	Janise loam, 0 to 2 percent slopes	4,800	0.7
Jo	Janise loam, drained, 0 to 2 percent slopes	14,600	2.1
JsB	Jayem loamy sand, overblown, 0 to 3 percent slopes	1,050	0.2
JxB	Jayem loamy fine sand, 0 to 3 percent slopes	2,400	0.4
JyB	Jayem fine sandy loam, 0 to 3 percent slopes	7,100	1.0
JyC	Jayem fine sandy loam, 3 to 6 percent slopes	1,450	0.2
Ke	Keith loam, 0 to 1 percent slopes	25,250	3.7
KeB	Keith loam, 1 to 3 percent slopes	24,650	3.6
KeC	Keith loam, 3 to 6 percent slopes	3,450	0.5
Lc	Lamo Variant loam, 0 to 1 percent slopes	880	0.1
Ln	Las Animas-Lisco very fine sandy loams, 0 to 2 percent slopes	3,800	0.6
Lo	Lisco very fine sandy loam, 0 to 2 percent slopes	3,850	0.6
Lp	Lisco very fine sandy loam, wet, 0 to 1 percent slopes	1,400	0.2
MaB	Manter-Satanta fine sandy loams, 0 to 3 percent slopes	3,000	0.4
MaC	Manter-Satanta fine sandy loams, 3 to 6 percent slopes	4,300	0.6
Mc	Marlake very fine sandy loam, 0 to 1 percent slopes	910	0.1
Md	McCook loam, 0 to 2 percent slopes	1,250	0.2
NoD	Norrest loam, 6 to 11 percent slopes	1,700	0.2
NoF	Norrest loam, 11 to 30 percent slopes	440	0.1
NpF	Norrest-Canyon complex, 11 to 30 percent slopes	2,200	0.3
OtD	Oglala-Canyon very fine sandy loams, 3 to 9 percent slopes	18,700	2.7
OtF	Oglala-Canyon very fine sandy loams, 9 to 30 percent slopes	8,800	1.3
Rh	Richfield loam, 0 to 1 percent slopes	4,300	0.6
RkG	Rock outcrop-Tassel complex, 11 to 60 percent slopes	340	*
Ro	Rosebud loam, 0 to 1 percent slopes	7,300	1.1
RoB	Rosebud loam, 1 to 3 percent slopes	11,300	1.7
RsD	Rosebud-Canyon complex, 3 to 9 percent slopes	24,900	3.8
RsF	Rosebud-Canyon complex, 9 to 30 percent slopes	3,950	0.6
SbB	Sarben-Busher loamy very fine sands, 0 to 3 percent slopes	16,100	2.4
SbD	Sarben-Busher loamy very fine sands, 3 to 9 percent slopes	19,400	2.8
StB	Satanta fine sandy loam, 0 to 3 percent slopes	13,100	1.9
StC	Satanta fine sandy loam, 3 to 6 percent slopes	3,700	0.5
StD	Satanta fine sandy loam, 6 to 9 percent slopes	780	0.1

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Su	Scott Variant loam, 0 to 1 percent slopes	1,050	0.2
TaF	Tassel loamy very fine sand, 3 to 30 percent slopes	4,800	0.7
VaD	Valent fine sand, 3 to 9 percent slopes	12,600	1.8
VaE	Valent fine sand, 9 to 17 percent slopes	3,000	0.4
VdB	Valent loamy fine sand, 0 to 3 percent slopes	9,400	1.4
VdD	Valent loamy fine sand, 3 to 9 percent slopes	25,750	3.8
VdE	Valent loamy fine sand, 9 to 17 percent slopes	8,800	1.3
VnD	Valentine fine sand, 3 to 9 percent slopes	6,400	0.9
VnE	Valentine fine sand, 9 to 17 percent slopes	8,100	1.2
VnF	Valentine fine sand, hilly	10,300	1.5
VtB	Vetal fine sandy loam, 0 to 3 percent slopes	6,500	1.0
VtC	Vetal fine sandy loam, 3 to 6 percent slopes	760	0.1
	Water	620	0.1
	Total	681,728	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
Ac	Alliance loam, 0 to 1 percent slopes (where irrigated)
AcB	Alliance loam, 1 to 3 percent slopes (where irrigated)
AcC	Alliance loam, 3 to 6 percent slopes (where irrigated)
ArB	Alliance-Rosebud loams, 1 to 3 percent slopes (where irrigated)
ArC	Alliance-Rosebud loams, 3 to 6 percent slopes (where irrigated)
Br	Bridget very fine sandy loam, 0 to 1 percent slopes (where irrigated)
BrB	Bridget very fine sandy loam, 1 to 3 percent slopes (where irrigated)
BrC	Bridget very fine sandy loam, 3 to 6 percent slopes (where irrigated)
CbB	Craft very fine sandy loam, 0 to 3 percent slopes (where irrigated)
Ce	Creighton very fine sandy loam, 0 to 1 percent slopes (where irrigated)
CeB	Creighton very fine sandy loam, 1 to 3 percent slopes (where irrigated)
CeC	Creighton very fine sandy loam, 3 to 6 percent slopes (where irrigated)
DrB	Duroc loam, 1 to 3 percent slopes (where irrigated)
Du	Duroc loam, occasionally flooded, 0 to 2 percent slopes (where irrigated)
Go	Goshen loam, 0 to 1 percent slopes (where irrigated)
Hm	Hemingford loam, 0 to 1 percent slopes (where irrigated)
HmB	Hemingford loam, 1 to 3 percent slopes (where irrigated)
HmC	Hemingford loam, 3 to 6 percent slopes (where irrigated)
JyB	Jayem fine sandy loam, 0 to 3 percent slopes (where irrigated)
JyC	Jayem fine sandy loam, 3 to 6 percent slopes (where irrigated)
Kc	Keith loam, 0 to 1 percent slopes (where irrigated)
KeB	Keith loam, 1 to 3 percent slopes (where irrigated)
KeC	Keith loam, 3 to 6 percent slopes (where irrigated)
MaB	Manter-Satanta fine sandy loams, 0 to 3 percent slopes (where irrigated)
MaC	Manter-Satanta fine sandy loams, 3 to 6 percent slopes (where irrigated)
Md	McCook loam, 0 to 2 percent slopes (where irrigated)
Rh	Richfield loam, 0 to 1 percent slopes (where irrigated)
Ro	Rosebud loam, 0 to 1 percent slopes (where irrigated)
RoB	Rosebud loam, 1 to 3 percent slopes (where irrigated)
StB	Satanta fine sandy loam, 0 to 3 percent slopes (where irrigated)
StC	Satanta fine sandy loam, 3 to 6 percent slopes (where irrigated)
VtB	Vetal fine sandy loam, 0 to 3 percent slopes (where irrigated)
VtC	Vetal fine sandy loam, 3 to 6 percent slopes (where irrigated)

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Dry beans	Winter wheat	Sugar beets	Alfalfa hay	
	I	I	N	I	N	I
	Bu	Bu	Bu	Ton	Ton	Ton
Ac----------------------- Alliance	140	38	43	24	1.8	5.6
AcB----------------------- Alliance	130	34	39	22	1.6	5.2
AcC----------------------- Alliance	115	30	34	18	1.3	4.7
ArB----------------------- Alliance-Rosebud	127	33	38	21	1.5	5.0
ArC----------------------- Alliance-Rosebud	112	28	32	17	1.2	4.5
ArD----------------------- Alliance-Rosebud	---	---	27	---	1.0	4.0
Ba----------------------- Bankard	---	---	---	---	---	---
BbB----------------------- Bankard	100	27	25	16	---	3.8
Br----------------------- Bridget	138	37	42	23	1.6	5.5
BrB----------------------- Bridget	130	34	39	22	1.4	5.0
BrC----------------------- Bridget	115	30	34	18	1.2	4.7
BuB----------------------- Busher-Jayem	120	30	34	19	1.2	4.6
BuC----------------------- Busher-Jayem	108	26	30	17	1.0	4.0
BuD----------------------- Busher-Jayem	---	---	25	---	0.8	3.6
BvC----------------------- Busher-Tassel	100	25	26	16	0.9	3.7
BvF----------------------- Busher-Tassel	---	---	---	---	---	---
CaF----------------------- Canyon	---	---	---	---	---	---
CbB----------------------- Craft	135	36	39	22	---	5.5
Ce----------------------- Creighton	136	36	40	23	1.5	5.4
CeB----------------------- Creighton	128	33	37	21	1.3	5.0
CeC----------------------- Creighton	114	29	32	18	1.1	4.5
CeD----------------------- Creighton	---	---	27	---	0.9	3.9
CnD----------------------- Creighton-Norrest	---	---	25	---	0.8	3.6

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Dry beans	Winter wheat	Sugar beets	Alfalfa hay	
	I	I	N	I	N	I
	Bu	Bu	Bu	Ton	Ton	Ton
CnF------------------------ Creighton-Norrest	---	---	---	---	---	---
DaB------------------------ Dailey	105	---	22	---	1.0	3.7
DaD------------------------ Dailey	95	---	---	---	---	3.4
DrB------------------------ Duroc	132	35	42	22	1.8	5.4
Du------------------------- Duroc	136	37	42	23	2.0	5.6
Go------------------------- Goshen	145	39	45	24	2.0	5.6
Hm------------------------- Hemingford	137	37	42	23	1.7	5.4
HmB------------------------ Hemingford	127	33	38	21	1.5	5.0
HmC------------------------ Hemingford	112	28	32	17	1.2	4.5
Ho------------------------- Hoffland	---	---	---	---	---	---
ImG------------------------ Imlay-Rock outcrop	---	---	---	---	---	---
IpB------------------------ Ipage	100	26	24	17	1.2	3.6
JaB------------------------ Janise	90	23	---	16	---	3.4
JcB------------------------ Janise	100	27	25	19	1.0	3.7
Jn------------------------- Janise	---	---	---	---	---	---
Jo------------------------- Janise	105	28	---	21	---	3.6
JsB------------------------ Jayem	115	28	29	18	1.1	4.2
JxB------------------------ Jayem	118	29	32	18	1.2	4.4
JyB------------------------ Jayem	125	33	38	21	1.3	4.9
JyC------------------------ Jayem	120	28	32	17	1.1	4.3
Ke------------------------- Keith	140	38	44	24	1.8	5.6
KeB------------------------ Keith	130	34	40	22	1.6	5.2
KeC------------------------ Keith	115	30	34	18	1.3	4.7
Lc------------------------- Lamo Variant	---	---	---	---	---	---

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Dry beans	Winter wheat	Sugar beets	Alfalfa hay	
	I	I	N	I	N	I
	Bu	Bu	Bu	Ton	Ton	Ton
Ln------------------------- Las Animas-Lisco	90	25	23	17	1.2	3.5
Lo, Lp------------------- Lisco	---	---	---	---	---	---
MaB------------------------ Manter-Satanta	128	33	39	21	1.4	5.0
MaC------------------------ Manter-Satanta	112	28	32	17	1.2	4.4
Mc------------------------- Marlake	---	---	---	---	---	---
Md------------------------- McCook	136	37	42	23	2.0	5.6
NoD------------------------ Norrest	---	---	23	---	0.7	---
NoF------------------------ Norrest	---	---	---	---	---	---
NpF------------------------ Norrest-Canyon	---	---	---	---	---	---
OtD------------------------ Oglala-Canyon	108	26	29	17	1.0	4.0
OtF------------------------ Oglala-Canyon	---	---	---	---	---	---
Rh------------------------- Richfield	138	37	42	23	1.7	5.4
RkG------------------------ Rock outcrop-Tassel	---	---	---	---	---	---
Ro------------------------- Rosebud	133	35	40	22	1.6	5.2
RoB------------------------ Rosebud	123	30	36	20	1.3	4.8
RsD------------------------ Rosebud-Canyon	105	25	28	16	1.0	3.8
RsF------------------------ Rosebud-Canyon	---	---	---	---	---	---
SbB------------------------ Sarben-Busher	115	28	31	18	1.1	4.4
SbD------------------------ Sarben-Busher	105	25	23	15	0.9	3.5
StB------------------------ Satanta	130	34	40	22	1.7	5.3
StC------------------------ Satanta	115	30	34	18	1.3	4.8
StD------------------------ Satanta	---	---	28	---	1.0	4.1
Su------------------------- Scott Variant	---	---	20	---	0.8	---
TaF------------------------ Tassel	---	---	---	---	---	---

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Dry beans	Winter wheat	Sugar beets	Alfalfa hay	
	I	I	N	I	N	I
	Bu	Bu	Bu	Ton	Ton	Ton
VaD------------------------ Valent	90	---	---	---	---	3.2
VaE------------------------ Valent	---	---	---	---	---	---
VdB------------------------ Valent	105	---	23	---	1.0	3.6
VdD------------------------ Valent	95	---	---	---	---	3.3
VdE------------------------ Valent	---	---	---	---	---	---
VnD------------------------ Valentine	90	---	---	---	---	3.2
VnE------------------------ Valentine	---	---	---	---	---	---
VnF------------------------ Valentine	---	---	---	---	---	---
VtB------------------------ Vetal	128	34	39	22	1.4	5.0
VtC------------------------ Vetal	114	29	33	18	1.2	4.5

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only those potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	76,800	---	---	---	---
II (N)	244,950	149,150	19,000	---	76,800
(I)	208,410	188,650	19,760	---	---
III (N)	108,250	108,250	---	---	---
(I)	105,790	105,790	---	---	---
IV (N)	135,410	118,960	1,050	15,400	---
(I)	192,210	160,110	---	32,100	---
V (N)	2,730	---	2,730	---	---
VI (N)	175,118	142,918	---	32,200	---
VII (N)	13,740	13,400	---	340	---
VIII(N)	910	---	910	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ac, AcB, AcC: Alliance	Silty	Favorable	2,500	Blue grama	25
		Normal	2,000	Western wheatgrass	25
		Unfavorable	1,000	Buffalograss	10
				Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	5
				Sand dropseed	5
ArB*, ArC*, ArD*:					
Alliance	Silty	Favorable	2,500	Blue grama	25
		Normal	2,000	Western wheatgrass	25
		Unfavorable	1,000	Buffalograss	10
				Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	5
				Sand dropseed	5
Rosebud	Silty	Favorable	2,500	Blue grama	20
		Normal	1,500	Needleandthread	15
		Unfavorable	1,000	Threadleaf sedge	10
				Buffalograss	10
				Green needlegrass	10
				Little bluestem	5
Ba: Bankard	Shallow To Gravel	Favorable	900	Blue grama	35
		Normal	600	Needleandthread	15
		Unfavorable	400	Sand dropseed	10
				Prairie sandreed	5
				Sand bluestem	5
				Sedge	5
BbB: Bankard	Sandy Lowland	Favorable	2,500	Prairie sandreed	25
		Normal	2,000	Switchgrass	20
		Unfavorable	1,500	Sand bluestem	15
				Sand dropseed	5
				Sand sagebrush	5
				Needleandthread	5
Br, BrB, BrC: Bridget	Silty	Favorable	2,500	Blue grama	25
		Normal	1,800	Western wheatgrass	20
		Unfavorable	1,200	Needleandthread	10
				Threadleaf sedge	10
				Buffalograss	10
				Little bluestem	5
				Sideoats grama	5
				Plains muhly	5
BuB*, BuC*, BuD*:					
Busher	Sandy	Favorable	2,300	Needleandthread	25
		Normal	1,800	Blue grama	20
		Unfavorable	1,300	Prairie sandreed	15
				Threadleaf sedge	10
				Sand dropseed	5
				Western wheatgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight (Lb/acre)	Characteristic vegetation	Composition (Pct)
BuB*, BuC*, BuD*: Jayem	Sandy	Favorable	2,200	Needleandthread	35
		Normal	1,700	Prairie sandreed	15
		Unfavorable	1,200	Blue grama	10
				Fringed sagewort	5
				Little bluestem	5
				Sand dropseed	5
				Threadleaf sedge	5
				Western wheatgrass	5
BvC*, BvF*: Busher	Sandy	Favorable	2,300	Needleandthread	25
		Normal	1,800	Blue grama	20
		Unfavorable	1,300	Prairie sandreed	15
				Threadleaf sedge	10
				Sand dropseed	5
				Western wheatgrass	5
Tassel	Shallow Limy	Favorable	1,200	Needleandthread	20
		Normal	800	Little bluestem	15
		Unfavorable	500	Threadleaf sedge	15
				Prairie sandreed	10
				Sand bluestem	10
				Blue grama	5
				Sideoats grama	5
				Plains muhly	5
CaF: Canyon	Shallow Limy	Favorable	1,100	Little bluestem	25
		Normal	800	Threadleaf sedge	15
		Unfavorable	500	Sideoats grama	10
				Blue grama	10
				Needleandthread	5
				Hairy grama	5
				Big bluestem	5
				Western wheatgrass	5
				Plains muhly	5
CbB: Craft	Silty Overflow	Favorable	2,700	Western wheatgrass	35
		Normal	2,300	Needleandthread	15
		Unfavorable	1,500	Big bluestem	10
				Blue grama	5
				Green needlegrass	5
				Sedge	5
Ce, CeB, CeC, CeD: Creighton	Silty	Favorable	2,200	Blue grama	20
		Normal	1,500	Western wheatthread	15
		Unfavorable	800	Needleandthread	15
				Green needlegrass	5
				Little bluestem	5
				Prairie junegrass	5
				Sandberg bluegrass	5
				Threadleaf sedge	5
CnD*, CnF*: Creighton	Silty	Favorable	2,200	Blue grama	20
		Normal	1,500	Western wheatgrass	15
		Unfavorable	800	Needleandthread	15
				Green needlegrass	5
				Little bluestem	5
				Prairie junegrass	5
				Sandberg bluegrass	5
				Threadleaf sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
CnD*, CnF*:					
Norrest	Limy Upland	Favorable	2,000	Blue grama	25
		Normal	1,400	Little bluestem	15
		Unfavorable	900	Western wheatgrass	15
				Sideoats grama	10
				Green needlegrass	5
				Sedge	5
DaB, DaD Dailey	Sandy	Favorable	2,200	Prairie sandreed	20
		Normal	1,600	Blue grama	15
		Unfavorable	1,400	Sand sagebrush	10
				Sand bluestem	10
				Sand dropseed	5
				Sedge	5
				Little bluestem	5
				Switchgrass	5
				Sideoats grama	5
				Needlegrass	5
DrB Duroc	Silty	Favorable	2,400	Western wheatgrass	35
		Normal	1,800	Needleandthread	15
		Unfavorable	1,200	Blue grama	10
				Big sagebrush	5
				Green needlegrass	5
				Little bluestem	5
				Prairie junegrass	5
				Sandberg bluegrass	5
				Threadleaf sedge	5
Du Duroc	Silty Overflow	Favorable	2,750	Western wheatgrass	30
		Normal	2,000	Big bluestem	10
		Unfavorable	1,500	Blue grama	10
				Buffalograss	5
				Little bluestem	5
				Sedge	5
				Sideoats grama	5
Go Goshen	Silty Lowland	Favorable	2,500	Blue grama	50
		Normal	1,900	Western wheatgrass	30
		Unfavorable	1,300	Buffalograss	10
Hm, HmB, HmC Hemingford	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,800	Needleandthread	20
		Unfavorable	1,000	Blue grama	15
				Threadleaf sedge	15
				Buffalograss	10
				Prairie sandreed	5
Ho Hoffland	Wet Land	Favorable	5,000	Prairie cordgrass	30
		Normal	4,500	Northern reedgrass	15
		Unfavorable	4,000	Bluejoint reedgrass	15
				Slender wheatgrass	10
				Rush	5
ImG*:					
Imlay	Shallow Limy	Favorable	1,200	Little bluestem	30
		Normal	900	Sideoats grama	10
		Unfavorable	600	Needleandthread	10
				Western wheatgrass	10
				Blue grama	10
				Green needlegrass	10
				Threadleaf sedge	10
Rock outcrop.					

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo-sition
			Lb/acre		Pct
IpB: Ipage	Sandy Lowland	Favorable	2,500	Prairie sandreed	25
		Normal	2,000	Needleandthread	15
		Unfavorable	1,000	Sand bluestem	10
				Blue grama	10
				Sand dropseed	5
				Prairie junegrass	5
				Threadleaf sedge	5
				Fringed sagebrush	5
				Leadplant	5
				Little bluestem	5
JaB: Janise	Saline Subirrigated	Favorable	3,000	Alkali sacaton	35
		Normal	2,300	Inland saltgrass	15
		Unfavorable	1,500	Slender wheatgrass	10
				Western wheatgrass	10
				Plains bluegrass	10
				Sedge	5
JcB: Janise	Saline Lowland	Favorable	2,600	Alkali sacaton	30
		Normal	1,800	Inland saltgrass	15
		Unfavorable	1,000	Western wheatgrass	15
				Blue grama	10
				Sedge	5
				Buffalograss	5
Jn: Janise	Saline Subirrigated	Favorable	3,000	Alkali sacaton	35
		Normal	2,300	Inland saltgrass	15
		Unfavorable	1,000	Western wheatgrass	10
				Slender wheatgrass	10
				Plains bluegrass	10
				Sedge	5
Jo: Janise	Saline Lowland	Favorable	2,600	Alkali sacaton	30
		Normal	1,800	Inland saltgrass	15
		Unfavorable	1,000	Western wheatgrass	15
				Blue grama	10
				Sedge	5
				Buffalograss	5
JsB: Jayem	Sandy	Favorable	2,000	Blue grama	25
		Normal	1,500	Needleandthread	25
		Unfavorable	700	Prairie sandreed	10
				Threadleaf sedge	10
				Sand dropseed	5
				Western wheatgrass	5
				Sand sagebrush	5
				Fringed sagewort	5
JxB, JyB, JyC: Jayem	Sandy	Favorable	2,200	Needleandthread	35
		Normal	1,700	Prairie sandreed	15
		Unfavorable	---	Blue grama	10
				Fringed sagewort	5
				Little bluestem	5
				Sand dropseed	5
				Threadleaf sedge	5
				Western wheatgrass	5
Ke, KeB, KeC: Keith	Silty	Favorable	2,500	Blue grama	25
		Normal	2,000	Western wheatgrass	20
		Unfavorable	1,200	Needleandthread	10
				Buffalograss	10
				Sedge	10
				Little bluestem	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Lc: Lamo Variant	Wet Subirrigated	Favorable	4,800	Prairie cordgrass	25
		Normal	4,300	Switchgrass	10
		Unfavorable	3,800	Indiangrass	10
				Big bluestem	10
				Slender wheatgrass	10
				Plains bluegrass	10
				Bluejoint reedgrass	5
				Northern reedgrass	5
Ln*:					
Las Animas	Subirrigated	Favorable	4,500	Little bluestem	20
		Normal	3,900	Indiangrass	10
		Unfavorable	3,250	Big bluestem	10
				Sedge	10
				Prairie cordgrass	10
				Slender wheatgrass	10
				Switchgrass	5
				Kentucky bluegrass	5
				Western wheatgrass	5
				Plains bluegrass	5
Lisco	Saline Subirrigated	Favorable	3,200	Alkali sacaton	40
		Normal	2,700	Western wheatgrass	20
		Unfavorable	2,200	Inland saltgrass	15
				Blue grama	5
				Sedge	5
				Plains bluegrass	5
Lo: Lisco	Saline Subirrigated	Favorable	3,200	Alkali sacaton	40
		Normal	2,700	Western wheatgrass	20
		Unfavorable	2,200	Inland saltgrass	15
				Blue grama	5
				Sedge	5
				Plains bluegrass	5
Lp: Lisco	Wet Land	Favorable	5,000	Prairie cordgrass	40
		Normal	4,500	Bluejoint reedgrass	10
		Unfavorable	4,000	Northern reedgrass	10
				Spikesedge	5
				Bulrush	5
				Sedge	5
MaB*, MaC*:					
Manter	Sandy	Favorable	2,000	Prairie sandreed	30
		Normal	1,600	Blue grama	20
		Unfavorable	1,200	Needleandthread	15
				Little bluestem	10
				Switchgrass	5
				Sand dropseed	5
Satanta	Sandy	Favorable	2,300	Prairie sandreed	25
		Normal	1,500	Blue grama	20
		Unfavorable	1,200	Needleandthread	20
				Little bluestem	10
				Western wheatgrass	5
				Sand dropseed	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Md----------------- McCook	Silty Overflow----------------	Favorable	2,500	Western wheatgrass------------	25
		Normal	2,000	Blue grama--------------------	15
		Unfavorable	1,500	Needleandthread---------------	15
				Big bluestem------------------	10
				Little bluestem---------------	10
				Canada wildrye----------------	5
				Sedge-------------------------	5
				Sideoats grama----------------	5
NoD, NoF----------- Norrest	Limy Upland-------------------	Favorable	2,000	Blue grama--------------------	25
		Normal	1,400	Western wheatgrass------------	15
		Unfavorable	900	Little bluestem---------------	15
				Sideoats grama----------------	10
				Green needlegrass-------------	5
				Sedge-------------------------	5
NpF*:					
Norrest-----------	Limy Upland-------------------	Favorable	2,000	Blue grama--------------------	25
		Normal	1,400	Western wheatgrass------------	15
		Unfavorable	900	Little bluestem---------------	15
				Sideoats grama----------------	10
				Green needlegrass-------------	5
				Sedge-------------------------	5
Canyon------------	Shallow Limy------------------	Favorable	1,100	Little bluestem---------------	25
		Normal	800	Threadleaf sedge--------------	15
		Unfavorable	500	Sideoats grama----------------	10
				Blue grama--------------------	10
				Needleandthread---------------	5
				Hairy grama-------------------	5
				Big bluestem------------------	5
				Western wheatgrass------------	5
				Plains muhly------------------	5
OtD*, OtF*:					
Oglala------------	Silty-------------------------	Favorable	2,600	Western wheatgrass------------	40
		Normal	2,200	Green needlegrass-------------	20
		Unfavorable	1,500	Needleandthread---------------	15
				Sideoats grama----------------	10
				Blue grama--------------------	10
Canyon------------	Shallow Limy------------------	Favorable	1,100	Little bluestem---------------	25
		Normal	800	Threadleaf sedge--------------	15
		Unfavorable	500	Sideoats grama----------------	10
				Blue grama--------------------	10
				Needleandthread---------------	5
				Hairy grama-------------------	5
				Big bluestem------------------	5
				Western wheatgrass------------	5
				Plains muhly------------------	5
Rh----------------- Richfield	Silty-------------------------	Favorable	2,400	Blue grama--------------------	20
		Normal	1,800	Big bluestem------------------	15
		Unfavorable	800	Sideoats grama----------------	15
				Western wheatgrass------------	15
				Buffalograss------------------	10
				Little bluestem---------------	5
RkG*: Rock outcrop.					

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
RkG*:					
Tassel	Shallow Limy	Favorable	1,200	Needleandthread	20
		Normal	800	Little bluestem	15
		Unfavorable	500	Threadleaf sedge	15
				Prairie sandreed	10
				Sand bluestem	10
				Blue grama	5
				Sideoats grama	5
				Plains muhly	5
Ro, RoB Rosebud	Silty	Favorable	2,500	Blue grama	20
		Normal	1,500	Needleandthread	15
		Unfavorable	1,000	Threadleaf sedge	10
				Buffalograss	10
				Green needlegrass	10
				Little bluestem	5
RsD*, RsF*:					
Rosebud	Silty	Favorable	2,500	Blue grama	20
		Normal	1,500	Needleandthread	15
		Unfavorable	1,000	Big bluestem	10
				Threadleaf sedge	10
				Buffalograss	10
				Green needlegrass	10
				Sideoats grama	5
				Little bluestem	5
Canyon	Shallow Limy	Favorable	1,100	Little bluestem	25
		Normal	800	Threadleaf sedge	15
		Unfavorable	500	Sideoats grama	10
				Blue grama	10
				Needleandthread	5
				Hairy grama	5
				Big bluestem	5
				Western wheatgrass	5
				Plains muhly	5
SbB*:					
Sarben	Sandy	Favorable	2,300	Prairie sandreed	30
		Normal	1,800	Needleandthread	15
		Unfavorable	1,200	Blue grama	15
				Little bluestem	10
				Sedge	10
				Sand bluestem	5
				Sand sagebrush	5
				Western wheatgrass	5
Busher	Sandy	Favorable	2,300	Needleandthread	25
		Normal	1,800	Blue grama	20
		Unfavorable	1,300	Prairie sandreed	15
				Threadleaf sedge	10
				Sand dropseed	5
				Western wheatgrass	5
SbD*:					
Sarben	Sandy	Favorable	2,500	Prairie sandreed	20
		Normal	2,000	Needleandthread	20
		Unfavorable	1,500	Little bluestem	15
				Blue grama	10
				Sand bluestem	10
				Sand sagebrush	5
				Western wheatgrass	5
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
SbD*:					
Busher	Sandy	Favorable	2,300	Needleandthread	25
		Normal	1,800	Blue grama	20
		Unfavorable	1,300	Prairie sandreed	15
				Threadleaf sedge	10
				Sand dropseed	5
				Western wheatgrass	5
StB, StC, StD: Satanta	Sandy	Favorable	2,300	Prairie sandreed	25
		Normal	1,500	Blue grama	20
		Unfavorable	1,200	Needleandthread	20
				Little bluestem	10
				Western wheatgrass	5
				Sand dropseed	5
Su: Scott Variant	Clayey Overflow	Favorable	2,500	Western wheatgrass	40
		Normal	1,500	Blue grama	15
		Unfavorable	700	Buffalograss	10
				Sideoats grama	10
				Green needlegrass	5
				Sandberg bluegrass	5
TaF: Tassel	Shallow Limy	Favorable	1,200	Needleandthread	20
		Normal	800	Little bluestem	15
		Unfavorable	500	Threadleaf sedge	15
				Prairie sandreed	10
				Sand bluestem	10
				Blue grama	5
				Sideoats grama	5
				Plains muhly	5
VaD, VaE: Valent	Sands	Favorable	2,200	Prairie sandreed	20
		Normal	1,700	Sand bluestem	15
		Unfavorable	1,200	Blue grama	10
				Needlegrass	10
				Little bluestem	5
				Sand dropseed	5
				Sideoats grama	5
				Switchgrass	5
				Sand sagebrush	5
VdB: Valent	Sandy	Favorable	2,200	Prairie sandreed	20
		Normal	1,700	Sand bluestem	15
		Unfavorable	1,200	Blue grama	10
				Needlegrass	10
				Little bluestem	5
				Sand dropseed	5
				Sideoats grama	5
				Switchgrass	5
				Sand sagebrush	5
VdD, VdE: Valent	Sands	Favorable	2,200	Prairie sandreed	20
		Normal	1,700	Sand bluestem	15
		Unfavorable	1,200	Blue grama	10
				Needlegrass	10
				Little bluestem	5
				Sand dropseed	5
				Sideoats grama	5
				Switchgrass	5
				Sand sagebrush	5
VnD, VnE: Valentine	Sands	Favorable	2,100	Sand bluestem	25
		Normal	1,600	Little bluestem	20
		Unfavorable	1,200	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Sand lovegrass	5
				Blue grama	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Compo-sition
		Kind of year	Dry weight		
			Lb/acre		Pct
VnF: Valentine	Choppy Sands	Favorable	2,200	Little bluestem	25
		Normal	1,500	Sand bluestem	20
		Unfavorable	800	Prairie sandreed	15
				Switchgrass	10
				Sand lovegrass	5
				Needleandthread	5
				Sandhill muhly	5
VtB: Vetal	Sandy	Favorable	2,300	Little bluestem	20
		Normal	1,800	Prairie sandreed	20
		Unfavorable	1,300	Needleandthread	10
				Blue grama	10
				Sand bluestem	10
				Western wheatgrass	5
VtC: Vetal	Sandy	Favorable	2,300	Little bluestem	25
		Normal	1,800	Prairie sandreed	25
		Unfavorable	1,300	Needleandthread	10
				Blue grama	10
				Western wheatgrass	5
				Sand bluestem	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ac, AcB, AcC: Alliance	American plum, lilac.	Rocky Mountain juniper, Siberian peashrub, common chokecherry.	Hackberry, Russian-olive, ponderosa pine, green ash, honeylocust, eastern redcedar.	Siberian elm	---
ArB*, ArC*, ArD*: Alliance	American plum, lilac.	Rocky Mountain juniper, Siberian peashrub, common chokecherry.	Hackberry, Russian-olive, ponderosa pine, green ash, honeylocust, eastern redcedar.	Siberian elm	---
Rosebud	Siberian peashrub, skunkbush sumac, Tatarian honeysuckle, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, hackberry, Russian-olive, green ash.	Honeylocust, Siberian elm, ponderosa pine.	---	---
Ba. Bankard					
BbB: Bankard	Lilac, Siberian peashrub, American plum, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, honeylocust, green ash, hackberry.	Siberian elm	---
Br, BrB, BrC: Bridget	Lilac, American plum.	Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Hackberry, ponderosa pine, Russian-olive, green ash, honeylocust, eastern redcedar.	Siberian elm	---
BuB*, BuC*: Busher	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---
Jayem	American plum, Tatarian honeysuckle, lilac.	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, Russian-olive, common chokecherry.	Green ash, ponderosa pine, honeylocust.	Siberian elm	---
BuD*: Busher	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
BuD*:					
Jayem	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
BvC*:					
Busher	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---
Tassel.					
BvF*:					
Busher.					
Tassel.					
CaF.					
Canyon					
CbB	American plum	Tatarian honeysuckle, lilac.	Eastern redcedar, ponderosa pine, Russian-olive, hackberry, green ash, Rocky Mountain juniper.	Siberian elm, honeylocust.	Eastern cottonwood.
Craft					
Ce, CeB, CeC, CeD	Lilac, American plum, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, hackberry, Siberian peashrub.	Ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm	---
Creighton					
CnD*:					
Creighton	Lilac, American plum, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, hackberry, Siberian peashrub.	Ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm	---
Norrest	Skunkbush sumac, lilac.	Rocky Mountain juniper, Russian-olive, Siberian peashrub, eastern redcedar, Tatarian honeysuckle, ponderosa pine, hackberry.	Honeylocust, green ash.	Siberian elm	---
CnF*:					
Creighton.					
Norrest.					
DaB	Common chokecherry, American plum, lilac, Tatarian honeysuckle.	Rocky Mountain juniper, Siberian peashrub, Russian-olive, eastern redcedar.	Ponderosa pine, green ash, honeylocust.	Siberian elm	---
Dailey					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
DaD: Dailey	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
DrB: Duroc	American plum, lilac, skunkbush sumac.	Siberian peashrub, hackberry, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, eastern redcedar, green ash, honeylocust.	Siberian elm	---
Du: Duroc	Lilac, American plum, Amur honeysuckle.	---	Rocky Mountain juniper, eastern redcedar, ponderosa pine, honeylocust, hackberry, green ash, Russian-olive.	Siberian elm	---
Go: Goshen	American plum, lilac, skunkbush sumac.	Siberian peashrub, hackberry, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, eastern redcedar, green ash, honeylocust.	Siberian elm	---
Hm, HmB, HmC: Hemingford	American plum, lilac, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, hackberry, Siberian peashrub.	Eastern redcedar, ponderosa pine, green ash, honeylocust.	Siberian elm	---
Ho. Hoffland					
ImG*: Imlay.					
Rock outcrop.					
IpB: Ipage	Lilac, silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Eastern redcedar, Russian-olive, ponderosa pine, green ash, Rocky Mountain juniper.	Siberian elm	---	---
JaB. Janise					
JcB: Janise	Eastern redcedar, Rocky Mountain juniper, lilac, silver buffaloberry, Siberian peashrub, Tatarian honeysuckle.	Ponderosa pine, Russian-olive, Siberian elm, green ash.	---	---	---
Jn, Jo. Janise					
JsB: Jayem	Lilac, American plum, Siberian peashrub.	Rocky Mountain juniper, Russian-olive, hackberry, eastern redcedar, common chokecherry.	Ponderosa pine, honeylocust, green ash.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
JxB, JyB, JyC------ Jayem	American plum, Tatarian honeysuckle, lilac.	Rocky Mountain juniper, eastern redcedar, Siberian peashrub, Russian-olive, common chokecherry.	Green ash, ponderosa pine, honeylocust.	Siberian elm------	---
Ke, KeB, KeC------ Keith	Common chokecherry, American plum, lilac.	Hackberry, Russian olive, green ash, Rocky Mountain juniper, Siberian peashrub.	Ponderosa pine, honeylocust, eastern redcedar.	Siberian elm------	---
Lc. Lamo Variant					
Ln*: Las Animas-------	Lilac, American plum.	Rocky Mountain juniper, Tatarian honeysuckle.	Eastern redcedar, green ash, ponderosa pine, hackberry, honeylocust.	Golden willow, Siberian elm.	Eastern cottonwood.
Lisco.					
Lo, Lp. Lisco					
MaB*, MaC*: Manter-----------	Common chokecherry, lilac, Amur honeysuckle, American plum.	Rocky Mountain juniper, Russian mulberry.	Eastern redcedar, ponderosa pine, hackberry, green ash, honeylocust.	Siberian elm------	---
Satanta----------	Lilac, common chokecherry, Amur honeysuckle, American plum.	Russian mulberry, Rocky Mountain juniper.	Ponderosa pine, eastern redcedar, green ash, hackberry, honeylocust.	Siberian elm------	---
Mc. Marlake					
Md---------------- McCook	American plum, lilac.	Tatarian honeysuckle.	Eastern redcedar, ponderosa pine, Russian-olive, hackberry, green ash, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
NoD--------------- Norrest	Skunkbush sumac, lilac.	Rocky Mountain juniper, Russian-olive, Siberian peashrub, eastern redcedar, Tatarian honeysuckle, ponderosa pine, hackberry.	Honeylocust, green ash.	Siberian elm------	---
NoF. Norrest					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
NpF*:					
Norrest.					
Canyon.					
OtD*:					
Oglala	Lilac	Green ash, Rocky Mountain juniper, common chokecherry, Siberian peashrub, American plum, hackberry.	Siberian elm, ponderosa pine, Russian-olive, eastern redcedar, honeylocust.	---	---
Canyon.					
OtF*:					
Oglala.					
Canyon.					
Rh Richfield	Lilac, American plum, common chokecherry.	Hackberry, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, ponderosa pine, eastern redcedar.	Siberian elm	---
RkG*:					
Rock outcrop.					
Tassel.					
Ro, RoB Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
RsD*:					
Rosebud	Siberian peashrub, skunkbush sumac, Tatarian honeysuckle, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, hackberry, Russian-olive, green ash.	Honeylocust, Siberian elm, ponderosa pine.	---	---
Canyon.					
RsF*:					
Rosebud.					
Canyon.					
SbB*:					
Sarben	Amur honeysuckle, American plum, common chokecherry, lilac.	Russian mulberry, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, hackberry, green ash, honeylocust.	Siberian elm	---
Busher	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
SbD*:					
Sarben	Amur honeysuckle, American plum, common chokecherry, lilac.	Rocky Mountain juniper, Russian mulberry.	Ponderosa pine, eastern redcedar, hackberry, green ash, honeylocust.	Siberian elm	---
Busher	Lilac, American plum, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---
StB, StC, StD Satanta	Lilac, common chokecherry, Amur honeysuckle, American plum.	Russian mulberry, Rocky Mountain juniper.	Ponderosa pine, eastern redcedar, green ash, hackberry, honeylocust.	Siberian elm	---
Su. Scott Variant					
TaF. Tassel					
VaD, VaE, VdB, VdD, VdE Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
VnD, VnE Valentine	---	Eastern redcedar, Austrian pine, Rocky Mountain juniper, jack pine.	Ponderosa pine	---	---
VnF. Valentine					
VtB, VtC Vetal	Skunkbush sumac, lilac, Tatarian honeysuckle.	Russian-olive, eastern redcedar, Siberian peashrub, Rocky Mountain juniper.	Ponderosa pine, hackberry, green ash, honeylocust.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ac-------------------- Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
AcB, AcC-------------- Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
ArB*, ArC*:					
Alliance-------------	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Rosebud--------------	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.	Moderate: thin layer.
ArD*:					
Alliance-------------	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope.
Rosebud--------------	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope, thin layer.
Ba-------------------- Bankard	Severe: flooding, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, flooding.
BbB------------------- Bankard	Severe: flooding.	Moderate: dusty.	Moderate: flooding.	Moderate: dusty.	Moderate: droughty, flooding.
Br-------------------- Bridget	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
BrB, BrC-------------- Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
BuB*:					
Busher---------------	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
Jayem----------------	Slight----------	Slight----------	Slight----------	Slight------------	Slight.
BuC*:					
Busher---------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
Jayem----------------	Slight----------	Slight----------	Moderate: slope.	Slight------------	Slight.
BuD*:					
Busher---------------	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.
Jayem----------------	Slight----------	Slight----------	Severe: slope.	Slight------------	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BvC*:					
Busher	Slight	Slight	Moderate: slope.	Slight	Slight.
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
BvF*:					
Busher	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
CaF Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope, dusty.	Severe: slope, thin layer.
CbB Craft	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Ce Creighton	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.	Slight.
CeB, CeC Creighton	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Slight.
CeD Creighton	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CnD*:					
Creighton	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Norrest	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: thin layer.
CnF*:					
Creighton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Norrest	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
DaB Dailey	Slight	Slight	Slight	Slight	Severe: droughty.
DaD Dailey	Slight	Slight	Severe: slope.	Slight	Severe: droughty.
DrB Duroc	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
Du Duroc	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Go Goshen	Severe: flooding.	Slight	Slight	Slight	Slight.
Hm Hemingford	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HmB, HmC: Hemingford	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Ho: Hoffland	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ImG*:					
Imlay	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Rock outcrop.					
IpB: Ipage	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.
JaB: Janise	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight	Severe: excess sodium.
JcB: Janise	Severe: flooding.	Slight	Slight	Slight	Slight.
Jn, Jo: Janise	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: dusty.	Severe: excess sodium.
JsB: Jayem	Slight	Slight	Slight	Slight	Slight.
JxB, JyB: Jayem	Slight	Slight	Slight	Slight	Slight.
JyC: Jayem	Slight	Slight	Moderate: slope.	Slight	Slight.
Ke: Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
KeB, KeC: Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Lc: Lamo Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ln*:					
Las Animas	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
Lisco	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: wetness.	Severe: excess sodium.
Lo: Lisco	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: wetness.	Severe: excess sodium.
Lp: Lisco	Severe: flooding, ponding, excess sodium.	Severe: ponding, excess sodium.	Severe: ponding, excess sodium.	Severe: ponding.	Severe: excess sodium, ponding.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MaB*:					
Manter	Slight	Slight	Slight	Slight	Slight.
Satanta	Slight	Slight	Slight	Slight	Slight.
MaC*:					
Manter	Slight	Slight	Moderate: slope.	Slight	Slight.
Satanta	Slight	Slight	Moderate: slope.	Slight	Slight.
Mc Marlake	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Md McCook	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
NoD Norrest	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
NoF Norrest	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
NpF*:					
Norrest	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope, dusty.	Severe: slope, thin layer.
OtD*:					
Oglala	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.	Slight.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: dusty.	Severe: thin layer.
OtF*:					
Oglala	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope, dusty.	Severe: slope, thin layer.
Rh Richfield	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
RkG*: Rock outcrop.					
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Ro Rosebud	Moderate: dusty.	Moderate: dusty.	Slight	Moderate: dusty.	Moderate: thin layer.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RoB: Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.	Moderate: thin layer.
RsD*:					
Rosebud	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.	Moderate: thin layer.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: dusty.	Severe: thin layer.
RsF*:					
Rosebud	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.	Severe: slope.
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Moderate: slope, dusty.	Severe: slope, thin layer.
SbB*:					
Sarben	Slight	Slight	Slight	Slight	Slight.
Busher	Slight	Slight	Slight	Slight	Slight.
SbD*:					
Sarben	Slight	Slight	Severe: slope.	Slight	Slight.
Busher	Slight	Slight	Severe: slope.	Slight	Slight.
StB: Satanta	Slight	Slight	Slight	Slight	Slight.
StC: Satanta	Slight	Slight	Moderate: slope.	Slight	Slight.
StD: Satanta	Slight	Slight	Severe: slope.	Slight	Slight.
Su: Scott Variant	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, erodes easily.	Severe: ponding.
TaF: Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
VaD: Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty.
VaE: Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope.
VdB: Valent	Slight	Slight	Slight	Slight	Moderate: droughty.
VdD: Valent	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
VdE: Valent	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
VnD: Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty.
VnE: Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope.
VnF: Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
VtB: Vetal	Slight	Slight	Slight	Slight	Slight.
VtC: Vetal	Slight	Slight	Moderate: slope.	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ac, AcB, AcC-------- Alliance	Good	Good	Good	Good	Good	Fair	Very poor.	Poor	Good	Good	Poor	Good.
ArB*:												
Alliance-----------	Good	Good	Good	Good	Good	Fair	Very poor.	Poor	Good	Good	Poor	Good.
Rosebud------------	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
ArC*:												
Alliance-----------	Good	Good	Good	Good	Good	Fair	Very poor.	Poor	Good	Good	Poor	Good.
Rosebud------------	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
ArD*:												
Alliance-----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Rosebud------------	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Ba----------------- Bankard	Poor	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
BbB---------------- Bankard	Fair	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.	Fair.
Br, BrB------------ Bridget	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BrC---------------- Bridget	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BuB*, BuC*, BuD*:												
Busher-------------	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Jayem--------------	Fair	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
BvC*:												
Busher-------------	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Tassel-------------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
BvF*:												
Busher-------------	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Tassel-------------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
CaF---------------- Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
CbB---------------- Craft	Good	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ce, CeB, CeC, CeD: Creighton	Fair	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
CnD*:												
Creighton	Fair	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Norrest	Poor	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
CnF*:												
Creighton	Poor	Fair	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Norrest	Very poor.	Very poor.	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
DaB, DaD: Dailey	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
DrB: Duroc	Fair	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Du: Duroc	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Go: Goshen	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Hm, HmB: Hemingford	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
HmC: Hemingford	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Ho: Hoffland	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
ImG*:												
Imlay	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Fair.
Rock outcrop.												
IpB: Ipage	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Fair.
JaB: Janise	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor	Poor	Poor.
JcB: Janise	Poor	Poor	Very poor.	Fair	Fair	Fair	Poor	Poor	Poor	Poor	Poor	Poor.
Jn: Janise	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor	Very poor.
Jo: Janise	Poor	Poor	Very poor.	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor.
JsB: Jayem	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
JxB, JyB, JyC: Jayem	Fair	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Ke, KeB: Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
KeC----------------- Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Lc------------------ Lamo Variant	Very poor.	Poor	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	Fair.
Ln*:												
Las Animas----------	Fair	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
Lisco---------------	Poor	Poor	Very poor.	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor.
Lo------------------ Lisco	Poor	Poor	Very poor.	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor.
Lp------------------ Lisco	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good	Poor.
MaB*, MaC*:												
Manter--------------	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Satanta-------------	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Mc------------------ Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Md------------------ McCook	Good	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
NoD----------------- Norrest	Poor	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
NoF----------------- Norrest	Very poor.	Very poor.	Good	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Good.
NpF*:												
Norrest-------------	Very poor.	Very poor.	Good	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Good.
Canyon--------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
OtD*:												
Oglala--------------	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Canyon--------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
OtF*:												
Oglala--------------	Very poor.	Very poor.	Good	Poor	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.	Good.
Canyon--------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Rh------------------ Richfield	Good	Good	Fair	Good	Good	Poor	Very poor.	Very poor.	Good	Good	Very poor.	Fair.
RkG*:												
Rock outcrop.												
Tassel--------------	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ro----------------- Rosebud	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
RoB---------------- Rosebud	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
RsD*:												
Rosebud-----------	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Canyon------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
RsF*:												
Rosebud-----------	Poor	Fair	Fair	Fair	Good	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Canyon------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
SbB*, SbD*:												
Sarben------------	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Busher------------	Fair	Good	Good	Fair	Poor	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
StB, StC----------- Satanta	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
StD---------------- Satanta	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Su----------------- Scott Variant	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor.
TaF---------------- Tassel	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
VaD, VaE, VdB, VdD- Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
VdE---------------- Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VnD, VnE----------- Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VnF---------------- Valentine	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VtB, VtC----------- Vetal	Fair	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ac, AcB: Alliance	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
AcC: Alliance	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
ArB*:						
Alliance	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: frost action.	Moderate: thin layer.
ArC*:						
Alliance	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
ArD*:						
Alliance	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Rosebud	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Ba, BbB: Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Br: Bridget	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
BrB: Bridget	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
BrC: Bridget	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
BuB*:						
Busher	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
BuC*, BuD*:						
Busher	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
BvC*:						
Busher	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Tassel	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BvF*:						
Busher	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
CaF: Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
CbB: Craft	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ce, CeB: Creighton	Slight	Slight	Slight	Slight	Slight	Slight.
CeC: Creighton	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
CeD: Creighton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
CnD*:						
Creighton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Norrest	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: thin layer.
CnF*:						
Creighton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Norrest	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
DaB: Dailey	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
DaD: Dailey	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
DrB: Duroc	Slight	Slight	Slight	Slight	Slight	Slight.
Du: Duroc	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Go: Goshen	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
Hm, HmB: Hemingford	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
HmC: Hemingford	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Ho: Hoffland	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
ImG*:						
Imlay	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rock outcrop.						
IpB Ipage	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Moderate: droughty.
JaB Janise	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Severe: excess sodium.
JcB Janise	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, shrink-swell.	Slight.
Jn Janise	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: frost action.	Severe: excess sodium.
Jo Janise	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Severe: excess sodium.
JsB, JxB, JyB Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
JyC Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Ke, KeB Keith	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.
KeC Keith	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Lc Lamo Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ln*:						
Las Animas	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: wetness, flooding.
Lisco	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: excess sodium.
Lo Lisco	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: excess sodium.
Lp Lisco	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding.	Severe: excess sodium, ponding.
MaB*:						
Manter	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
MaC*:						
Manter	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Mc Marlake	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Md McCook	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
NoD Norrest	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
NoF Norrest	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
NpF*:						
Norrest	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
OtD*:						
Oglala	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
OtF*:						
Oglala	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rh Richfield	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
RkG*:						
Rock outcrop.						
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Ro, RoB Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: frost action.	Moderate: thin layer.
RsD*:						
Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
RsD*:						
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
RsF*:						
Rosebud	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
SbB*:						
Sarben	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
Busher	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
SbD*:						
Sarben	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Busher	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
StB Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
StC, StD Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Su Scott Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
TaF Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
VaD Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaE Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
VdB Valent	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VdD Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VdE Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
VnD Valentine	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VnE Valentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
VnF Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
VtB--------------- Vetal	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
VtC--------------- Vetal	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ac: Alliance	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
AcB, AcC: Alliance	Moderate: depth to rock.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
ArB*, ArC*:					
Alliance	Moderate: depth to rock.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
ArD*:					
Alliance	Moderate: depth to rock, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, slope, thin layer.
Rosebud	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Ba, BbB: Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
Br: Bridget	Moderate: flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
BrB, BrC: Bridget	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
BuB*, BuC*:					
Busher	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: area reclaim, thin layer.
Jayem	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
BuD*:					
Busher	Moderate: depth to rock.	Severe: seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: area reclaim, thin layer.
Jayem	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
BvC*:					
Busher	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: area reclaim, thin layer.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BvC*:					
Tassel	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
BvF*:					
Busher	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: slope.
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
CaF: Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
CbB: Craft	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding.	Severe: flooding.	Good.
Ce: Creighton	Slight	Moderate: seepage.	Slight	Slight	Good.
CeB, CeC: Creighton	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
CeD: Creighton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
CnD*:					
Creighton	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Norrest	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
CnF*:					
Creighton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Norrest	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
DaB, DaD: Dailey	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
DrB: Duroc	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Du: Duroc	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Go: Goshen	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Hm------------------- Hemingford	Severe: percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
HmB, HmC------------ Hemingford	Severe: percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
Ho------------------ Hoffland	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
ImG*:					
Imlay---------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Rock outcrop.					
IpB----------------- Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
JaB----------------- Janise	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness, excess sodium.	Severe: wetness.	Poor: excess sodium.
JcB----------------- Janise	Severe: percs slowly.	Severe: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Jn------------------ Janise	Severe: wetness.	Severe: flooding, wetness.	Severe: wetness, excess sodium.	Severe: wetness.	Poor: excess sodium.
Jo------------------ Janise	Moderate: flooding, percs slowly.	Moderate: seepage.	Severe: excess salt.	Moderate: flooding.	Poor: excess sodium.
JsB----------------- Jayem	Slight-----------	Severe: seepage.	Slight-----------	Severe: seepage.	Good.
JxB, JyB, JyC------- Jayem	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Ke------------------ Keith	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
KeB, KeC------------ Keith	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
Lc------------------ Lamo Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Ln*:					
Las Animas----------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: too sandy, wetness.
Lisco---------------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: excess salt, excess sodium.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lo------------------ Lisco	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: excess salt, excess sodium.
Lp------------------ Lisco	Severe: flooding, ponding.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess sodium.
MaB*:					
Manter-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Satanta------------	Slight-----------	Moderate: seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
MaC*:					
Manter-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Satanta------------	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
Mc------------------ Marlake	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Md------------------ McCook	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
NoD----------------- Norrest	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
NoF----------------- Norrest	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
NpF*:					
Norrest------------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, hard to pack, slope.
Canyon-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
OtD*:					
Oglala-------------	Moderate: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
Canyon-------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
OtF*:					
Oglala-------------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OtF*:					
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rh Richfield	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
RkG*: Rock outcrop.					
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Ro, RoB Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
RsD*:					
Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
RsF*:					
Rosebud	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
SbB*, SbD*:					
Sarben	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Good.
Busher	Moderate: depth to rock.	Severe: seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: area reclaim, thin layer.
StB Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
StC Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
StD Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Su Scott Variant	Severe: ponding.	Severe: ponding.	Severe: depth to rock, ponding.	Severe: ponding.	Poor: ponding, thin layer.
TaF Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
VaD Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VaE------------------ Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.
VdB, VdD------------- Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight------------	Poor: too sandy.
VdE------------------ Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.
VnD------------------ Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VnE------------------ Valentine	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VnF------------------ Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VtB, VtC------------- Vetal	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ac, AcB, AcC: Alliance	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
ArB*, ArC*:				
Alliance	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
ArD*:				
Alliance	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Ba: Bankard	Good	Probable	Improbable: too sandy.	Poor: too sandy.
BbB: Bankard	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
Br, BrB, BrC: Bridget	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
BuB*, BuC*, BuD*:				
Busher	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
BvC*:				
Busher	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
BvF*:				
Busher	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CaF------------------ Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
CbB------------------ Craft	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Ce, CeB, CeC---------- Creighton	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
CeD------------------ Creighton	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
CnD*:				
Creighton------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Norrest--------------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CnF*:				
Creighton------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Norrest--------------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
DaB, DaD------------- Dailey	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
DrB------------------ Duroc	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Du------------------- Duroc	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Go------------------- Goshen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hm, HmB, HmC---------- Hemingford	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ho------------------- Hoffland	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: thin layer, wetness.
ImG*:				
Imlay----------------	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
IpB------------------ Ipage	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: thin layer.
JaB------------------ Janise	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
JcB------------------ Janise	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Jn: Janise	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
Jo: Janise	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
JsB: Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
JxB: Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
JyB, JyC: Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Ke, KeB, KeC: Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lc: Lamo Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ln*:				
Las Animas	Fair: wetness.	Probable	Improbable: excess fines.	Good.
Lisco	Fair: wetness.	Probable	Improbable: too sandy.	Poor: excess sodium.
Lo: Lisco	Fair: wetness.	Probable	Improbable: too sandy.	Poor: excess sodium.
Lp: Lisco	Poor: wetness.	Probable	Improbable: excess fines.	Poor: wetness, excess sodium.
MaB*, MaC*:				
Manter	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Mc: Marlake	Poor: wetness.	Probable	Improbable: too sandy.	Poor: thin layer, wetness.
Md: McCook	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
NoD: Norrest	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
NoF: Norrest	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
NpF*:				
Norrest	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OtD*:				
Oglala	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
OtF*:				
Oglala	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rh: Richfield	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
RkG*: Rock outcrop.				
Tassel	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Ro, RoB: Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
RsD*:				
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
RsF*:				
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
SbB*, SbD*:				
Sarben	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Busher	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
StB, StC, StD: Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Su: Scott Variant	Poor: thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
TaF: Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
VaD, VaE: Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VdB, VdD: Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.
VdE: Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
VnD, VnE: Valentine	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VnF: Valentine	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VtB, VtC: Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ac, AcB: Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
AcC: Alliance	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
ArB*:						
Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
ArC*:						
Alliance	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Rosebud	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
ArD*:						
Alliance	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Rosebud	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Ba: Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
BbB: Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty	Too sandy	Droughty.
Br, BrB: Bridget	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Erodes easily.
BrC: Bridget	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
BuB*:						
Busher	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
BuC*, BuD*:						
Busher	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
BvC*:						
Busher	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
Tassel	Severe: depth to rock.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Depth to rock, soil blowing.	Depth to rock.
BvF*:						
Busher	Severe: seepage, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Slope, soil blowing.	Slope.
Tassel	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
CaF: Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
CbB: Craft	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ce, CeB: Creighton	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
CeC: Creighton	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
CeD: Creighton	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
CnD*:						
Creighton	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Norrest	Moderate: depth to rock, slope.	Moderate: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
CnF*:						
Creighton	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Norrest	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
DaB, DaD: Dailey	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DrB: Duroc	Moderate: seepage.	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
Du: Duroc	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Go: Goshen	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable	Erodes easily	Erodes easily.
Hm, HmB: Hemingford	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
HmC: Hemingford	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Ho: Hoffland	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.
ImG*: Imlay	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock, percs slowly.
Rock outcrop.						
IpB: Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
JaB: Janise	Moderate: seepage.	Severe: piping, excess sodium.	Excess sodium	Wetness, fast intake, soil blowing.	Erodes easily, wetness, soil blowing.	Erodes easily, excess sodium.
JcB: Janise	Moderate: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, excess salt, excess sodium.	Erodes easily, soil blowing.	Erodes easily, excess sodium.
Jn: Janise	Moderate: seepage.	Severe: piping, excess sodium, excess salt.	Frost action, excess salt.	Wetness, erodes easily, excess salt, excess sodium.	Erodes easily, wetness.	Excess salt, erodes easily, excess sodium.
Jo: Janise	Moderate: seepage.	Severe: piping, excess salt, excess sodium.	Deep to water	Erodes easily, excess salt, excess sodium.	Erodes easily	Erodes easily, excess sodium.
JsB: Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Erodes easily, soil blowing.	Erodes easily.
JxB: Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
JyB: Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
JyC: Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Ke, KeB: Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
KeC: Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Lc: Lamo Variant	Moderate: seepage.	Severe: piping, ponding.	Ponding	Ponding	Erodes easily, ponding.	Wetness, erodes easily.
Ln*: Las Animas	Severe: seepage.	Severe: piping, wetness.	Flooding, cutbanks cave.	Wetness, soil blowing, flooding.	Wetness, soil blowing.	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ln*:						
Lisco	Severe: seepage.	Severe: piping, wetness, excess sodium.	Flooding, excess salt, excess sodium.	Wetness, flooding.	Erodes easily, wetness.	Excess sodium, erodes easily.
Lo: Lisco	Severe: seepage.	Severe: piping, wetness, excess sodium.	Flooding, excess salt, excess sodium.	Wetness, flooding.	Erodes easily, wetness.	Excess sodium, erodes easily.
Lp: Lisco	Severe: seepage.	Severe: piping, ponding, excess sodium.	Ponding, flooding, cutbanks cave.	Ponding, erodes easily, flooding.	Erodes easily, ponding.	Wetness, excess sodium, erodes easily.
MaB*:						
Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
MaC*:						
Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Mc: Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Md: McCook	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
NoD, NoF: Norrest	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
NpF*:						
Norrest	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Depth to rock, slope, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
OtD*:						
Oglala	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
OtF*:						
Oglala	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, erodes easily, soil blowing.	Slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
OtF*:						
Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rh Richfield	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
RkG*:						
Rock outcrop.						
Tassel	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Ro, RoB Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
RsD*:						
Rosebud	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
RsF*:						
Rosebud	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
SbB*:						
Sarben	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
Busher	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
SbD*:						
Sarben	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
Busher	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
StB Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
StC, StD Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Su Scott Variant	Moderate: seepage, depth to rock.	Severe: piping, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
TaF Tassel	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
VaD Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
VaE--------------- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VdB, VdD---------- Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VdE--------------- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VnD--------------- Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VnE, VnF---------- Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VtB--------------- Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
VtC--------------- Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ac, AcB, AcC------ Alliance	0-8	Loam-------------	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	8-16	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	80-100	30-50	15-25
	16-20	Silt loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	20-46	Very fine sandy loam, silt loam, loam.	ML	A-4	<5	85-90	85-90	60-70	51-65	<30	NP
	46-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ArB*, ArC*, ArD*:											
Alliance---------	0-8	Loam-------------	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	8-21	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	80-100	30-50	15-25
	21-26	Silt loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	26-42	Very fine sandy loam, silt loam, loam.	ML	A-4	<5	85-90	85-90	60-70	51-65	<30	NP
	42-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rosebud----------	0-8	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-95	55-90	24-34	3-12
	8-24	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	24-34	Sandy loam, loam, very fine sandy loam.	SM, ML, SC, CL	A-4, A-6	0	95-100	80-100	60-85	35-60	20-40	2-12
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ba--------------- Bankard	0-6	Fine sand--------	SM	A-2	0	95-100	90-100	65-80	20-35	---	NP
	6-60	Stratified loamy fine sand to gravelly coarse sand.	SP, SP-SM, SM	A-2, A-3	0	90-100	50-100	50-75	0-20	---	NP
BbB-------------- Bankard	0-4	Very fine sandy loam.	ML, SM	A-4	0	95-100	85-100	60-85	40-65	2-30	NP-10
	4-60	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-3, A-1	<5	80-100	75-100	40-70	5-35	---	NP
Br, BrB, BrC------ Bridget	0-14	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-10
	14-19	Very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-10
	19-60	Very fine sandy loam, loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-10
BuB*, BuC*, BuD*:											
Busher-----------	0-12	Loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	12-58	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	58-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BuB*, BuC*, BuD*: Jayem-----------	0-8	Loamy very fine sand.	SM	A-4, A-2	0	85-100	75-100	55-95	25-50	20-25	NP-5
	8-37	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	37-60	Loamy sand, loamy fine sand, sand.	SM	A-2	0	85-100	75-100	65-80	25-35	---	NP
BvC*, BvF*: Busher-----------	0-13	Loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	13-55	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	55-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel-----------	0-4	Loamy very fine sand.	ML, SM	A-4, A-2	0	95-100	90-100	75-100	30-65	<25	NP-7
	4-14	Fine sandy loam, loamy very fine sand, loamy fine sand.	ML, SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-7
	14-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CaF--------------- Canyon	0-7	Very fine sandy loam.	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	7-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CbB--------------- Craft	0-5	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	50-98	<25	NP-15
	5-60	Very fine sandy loam, silt loam, loam.	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	85-100	50-98	<25	NP-15
Ce, CeB, CeC, CeD-------------- Creighton	0-8	Very fine sandy loam.	ML	A-4	0	100	90-100	85-100	50-65	20-25	NP-5
	8-20	Very fine sandy loam, loam.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
	20-60	Very fine sandy loam, loam, loamy very fine sand.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
CnD*, CnF*: Creighton-------	0-9	Very fine sandy loam.	ML	A-4	0	100	90-100	85-100	50-65	20-25	NP-5
	9-23	Very fine sandy loam, loam.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
	23-60	Very fine sandy loam, loam, loamy very fine sand.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
Norrest---------	0-4	Loam-------------	ML, CL	A-6, A-7	0	100	100	90-100	70-100	35-45	10-20
	4-24	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	24-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
DaB, DaD---------- Dailey	0-15	Loamy sand-------	SM	A-2, A-4	0	100	100	70-95	20-40	---	NP
	15-60	Loamy sand, fine sand, sand.	SP-SM, SM	A-2, A-3	0	100	95-100	75-95	5-35	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DrB------------- Duroc	0-5	Loam-------------	ML, CL-ML	A-4	0	100	90-100	85-95	75-85	25-35	5-10
	5-35	Loam, silt loam	ML, CL-ML	A-4	0	100	90-100	85-95	65-85	25-35	5-10
	35-60	Loam, silt loam	ML, CL-ML	A-4	0	100	90-100	85-95	65-85	25-35	5-10
Du-------------- Duroc	0-29	Loam-------------	ML, CL-ML	A-4	0	100	100	95-100	50-85	20-30	NP-10
	29-60	Very fine sandy loam, loam, silt loam.	ML, CL-ML	A-4	0	100	100	95-100	50-85	20-30	NP-10
Go-------------- Goshen	0-9	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	70-95	20-40	3-20
	9-35	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	65-95	25-40	8-22
	35-60	Silt loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-35	4-15
Hm, HmB, HmC----- Hemingford	0-10	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	20-35	5-15
	10-25	Clay loam, sandy clay loam, loam.	CL, SC	A-6, A-7	0	100	100	80-100	35-85	30-50	12-25
	25-42	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-6, A-4	0	95-100	90-100	85-100	35-85	25-40	5-15
	42-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ho-------------- Hoffland	0-5	Fine sandy loam	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	70-95	40-75	15-35	4-14
	5-42	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	---	NP
	42-51	Fine sandy loam	SM, SM-SC	A-4	0	100	100	70-85	35-45	<20	NP-7
	51-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-35	---	NP
ImG*:											
Imlay-----------	0-12	Loam-------------	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-95	30-45	10-20
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
IpB------------- Ipage	0-6	Loamy fine sand	SM	A-2, A-4	0	100	100	80-100	15-40	---	NP
	6-60	Loamy fine sand, loamy sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	100	80-100	5-35	---	NP
JaB------------- Janise	0-15	Loamy fine sand	SM, SM-SC, ML, CL-ML	A-2, A-4	0	100	100	75-100	15-55	<20	NP-5
	15-25	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	65-95	20-40	5-20
	25-60	Loam, very fine sandy loam, silt loam.	ML, CL, CL-ML	A-4	0	100	100	90-100	55-90	20-35	3-10
JcB------------- Janise	0-18	Loamy fine sand	SM, SM-SC	A-2, A-4	0	100	100	80-100	15-40	<20	NP-5
	18-29	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	25-40	5-15
	29-60	Very fine sandy loam, loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	50-90	<25	NP-12
Jn-------------- Janise	0-2	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-90	20-35	3-15
	2-6	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	25-50	10-25
	6-60	Loam, very fine sandy loam, silt loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	65-100	20-35	3-14

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Jo-----------------Janise	0-2	Loam--------------	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	65-95	20-35	2-12
	2-10	Loam, silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	70-95	25-40	5-15
	10-60	Very fine sandy loam, loam, silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	50-90	<25	NP-12
JsB----------------Jayem	0-28	Loamy sand--------	SM	A-2	0	100	100	75-98	15-30	---	NP
	28-38	Loam, silt loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	65-95	25-40	5-20
	38-60	Very fine sandy loam, loam.	ML	A-4	0	100	100	90-100	55-90	20-35	NP-10
JxB----------------Jayem	0-14	Loamy fine sand	SM	A-2	0	85-100	75-100	75-85	25-35	20-25	NP-5
	14-34	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	34-51	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	51-60	Loamy sand, loamy fine sand, sand.	SM	A-2	0	85-100	75-100	65-80	25-35	---	NP
JyB, JyC-----------Jayem	0-11	Fine sandy loam	SM	A-4, A-2	0	85-100	75-100	55-95	25-50	20-25	NP-5
	11-26	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	26-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
Ke, KeB, KeC-------Keith	0-8	Loam--------------	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	8-36	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	36-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Lc-----------------Lamo Variant	0-5	Loam--------------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	50-90	20-35	2-12
	5-37	Loam, very fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	55-95	20-40	4-18
	37-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	50-90	20-35	2-12
Ln*: Las Animas------	0-9	Very fine sandy loam.	SM, ML	A-4	0	100	95-100	70-90	40-60	20-25	NP-5
	9-42	Stratified very fine sandy loam to loamy fine sand.	SM, ML	A-2, A-4	0	95-100	90-100	55-90	25-55	20-25	NP-5
	42-60	Fine sand---------	SM, SP-SM	A-2, A-3	0	100	95-100	75-100	5-25	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ln*:											
Lisco	0-5	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	<25	NP-10
	5-10	Very fine sandy loam, loam, loamy very fine sand.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	<25	NP-10
	10-40	Very fine sandy loam, fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4, A-2	0	100	95-100	60-95	30-65	<25	NP-5
	40-60	Fine sandy loam, loamy fine sand, sand.	SM, SP-SM, ML, SM-SC	A-4, A-2, A-3	0	100	95-100	51-85	5-55	<20	NP-5
Lo Lisco	0-5	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	<25	NP-10
	5-18	Very fine sandy loam, loam, loamy very fine sand.	ML, CL-ML, CL	A-4	0	100	100	85-100	50-90	<25	NP-10
	18-60	Very fine sandy loam, fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4, A-2	0	100	95-100	60-95	30-65	<25	NP-5
Lp Lisco	0-4	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	95-100	50-90	15-30	NP-10
	4-15	Very fine sandy loam, loam, fine sandy loam.	ML, SM, CL, SC	A-4	0	100	100	90-100	35-75	15-30	NP-10
	15-60	Very fine sandy loam, loamy very fine sand.	ML, SM, SM-SC	A-4	0	100	95-100	80-100	40-70	<25	NP-5
MaB*, MaC*:											
Manter	0-12	Fine sandy loam	SM, ML	A-2, A-4	0	95-100	75-100	45-85	25-55	---	NP
	12-34	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	34-60	Sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
Satanta	0-16	Fine sandy loam	SM, ML	A-4	0	100	95-100	60-85	45-60	<25	NP-5
	16-31	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	31-60	Loam, clay loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Mc Marlake	0-13	Very fine sandy loam.	SM, ML	A-4	0	100	100	70-85	40-55	<20	NP
	13-20	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	100	50-85	5-35	---	NP
	20-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
Md McCook	0-12	Loam	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	12-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	80-100	<20	NP-10
NoD, NoF Norrest	0-4	Loam	ML, CL	A-6, A-7	0	100	100	90-100	70-100	35-45	10-20
	4-21	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	21-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
NpF*:											
Norrest	0-4	Loam	ML, CL	A-6, A-7	0	100	100	90-100	70-100	35-45	10-20
	4-22	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon	0-7	Very fine sandy loam.	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	7-15	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OtD*, OtF*:											
Oglala	0-8	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	100	51-65	20-30	NP-7
	8-53	Loam, very fine sandy loam, loamy very fine sand.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	51-75	25-40	5-15
	53-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon	0-11	Very fine sandy loam.	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	11-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rh Richfield	0-8	Loam	CL-ML, CL, ML	A-4, A-6	0	100	100	90-100	70-100	20-35	2-15
	8-26	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	40-60	20-35
	26-60	Silty clay loam, silt loam, loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	5-20
RkG*:											
Rock outcrop.											
Tassel	0-3	Loamy very fine sand.	ML, SM	A-4	0	95-100	90-100	75-100	40-65	<35	NP-7
	3-12	Fine sandy loam, loamy very fine sand, loamy fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	<35	NP-7
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ro, RoB Rosebud	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-95	55-90	24-34	3-12
	7-24	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	24-35	Sandy loam, loam, very fine sandy loam.	SM, ML, SC, CL	A-4, A-6	0	95-100	80-100	60-85	35-60	20-40	2-12
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RsD*, RsF*:											
Rosebud	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-95	55-90	24-34	3-12
	7-24	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	24-35	Sandy loam, loam, very fine sandy loam.	SM, ML, SC, CL	A-4, A-6	0	95-100	80-100	60-85	35-60	20-40	2-12
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
RsD*, RsF*:											
Canyon----------	0-10	Very fine sandy loam.	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	10-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SbB*:											
Sarben----------	0-6	Loamy very fine sand.	SM, ML	A-4, A-2	0	100	100	90-100	30-60	<25	NP
	6-15	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
	15-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
Busher----------	0-3	Loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	3-40	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	40-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SbD*:											
Sarben----------	0-3	Loamy very fine sand.	SM, ML	A-4, A-2	0	100	100	90-100	30-60	<25	NP
	3-15	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
	15-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
Busher----------	0-3	Loamy very fine sand.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	3-40	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	40-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
StB, StC, StD---- Satanta	0-13	Fine sandy loam	SM, ML	A-4	0	100	95-100	60-85	45-60	<25	NP-5
	13-31	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	31-60	Loam, clay loam, very fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Su--------------- Scott Variant	0-9	Loam------------	ML, CL-ML, CL	A-4, A-6	0	100	100	95-100	60-90	20-35	3-15
	9-22	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	100	100	95-100	85-95	50-65	25-40
	22-41	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	100	100	90-100	60-90	20-35	3-10
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TaF-------------- Tassel	0-7	Loamy very fine sand.	ML, SM	A-4, A-2	0	95-100	90-100	75-100	30-65	<35	NP-7
	7-18	Fine sandy loam, loamy very fine sand, loamy fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	<35	NP-7
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
VaD, VaE--------- Valent	0-4	Fine sand--------	SM, SP-SM	A-2	0	100	100	80-95	10-30	---	NP
	4-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
VdB, VdD, VdE---- Valent	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	80-95	10-30	---	NP
	5-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
VnD, VnE, VnF---- Valentine	0-3	Fine sand--------	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	3-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
VtB, VtC--------- Vetal	0-10	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	85-100	30-55	20-30	NP-7
	10-36	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-7
	36-60	Fine sandy loam, very fine sandy loam, sandy loam, loamy fine sand.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
Ac, AcB, AcC: Alliance	0-8	18-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low	0.32	5	6	2-4
	8-16	25-35	1.15-1.30	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	16-20	16-25	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low	0.43			
	20-46	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low	0.43			
	46-60	---	---	---	---	---	---	---	---			
ArB*, ArC*, ArD*: Alliance	0-8	18-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low	0.32	5	6	2-4
	8-21	25-35	1.15-1.30	0.6-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	21-26	16-25	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low	0.43			
	26-42	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low	0.43			
	42-60	---	---	---	---	---	---	---	---			
Rosebud	0-8	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low	0.28	4	6	2-4
	8-24	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-7.8	<2	Moderate	0.28			
	24-34	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low	0.28			
	34-60	---	---	---	---	---	---	---	---			
Ba: Bankard	0-6	0-8	1.85-1.95	>20	0.08-0.10	7.4-8.4	<2	Low	0.15	5	1	.5-1
	6-60	0-10	1.85-2.00	6.0-20	0.07-0.14	7.4-8.4	<2	Low	0.17			
BbB: Bankard	0-4	15-27	1.35-1.45	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.37	5	3	.5-1
	4-60	2-10	1.70-1.80	6.0-20	0.06-0.08	7.4-8.4	<2	Low	0.10			
Br, BrB, BrC: Bridget	0-14	10-18	1.20-1.45	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low	0.32	5	3	1-2
	14-19	13-18	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low	0.43			
	19-60	13-18	1.20-1.45	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low	0.43			
BuB*, BuC*, BuD*: Busher	0-12	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low	0.20	5	2	1-2
	12-58	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low	0.20			
	58-60	---	---	---	---	---	---	---	---			
Jayem	0-8	5-15	1.40-1.60	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.20	5	2	1-2
	8-37	5-18	1.45-1.65	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.28			
	37-60	3-10	1.60-1.80	2.0-6.0	0.07-0.09	6.6-7.8	<2	Low	0.24			
BvC*, BvF*: Busher	0-13	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low	0.20	5	2	1-2
	13-55	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low	0.20			
	55-60	---	---	---	---	---	---	---	---			
Tassel	0-4	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low	0.20	2	2	.5-1
	4-14	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	0.20			
	14-60	---	---	---	---	---	---	---	---			
CaF: Canyon	0-7	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.32	2	4L	.5-1
	7-14	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	0.43			
	14-60	---	---	---	---	---	---	---	---			
CbB: Craft	0-5	8-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.37	5	4L	1-2
	5-60	8-20	1.20-1.40	2.0-6.0	0.17-0.19	7.4-8.4	<2	Low	0.43			
Ce, CeB, CeC, CeD: Creighton	0-8	5-15	1.40-1.55	0.6-2.0	0.15-0.17	6.1-7.8	<2	Low	0.32	5	3	1-2
	8-20	5-18	1.40-1.55	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.43			
	20-60	5-18	1.35-1.45	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	0.43			
CnD*, CnF*: Creighton	0-9	5-15	1.40-1.55	0.6-2.0	0.15-0.17	6.1-7.8	<2	Low	0.32	5	3	1-2
	9-23	5-18	1.40-1.55	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.43			
	23-60	5-18	1.35-1.45	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
CnD*, CnF*:												
Norrest	0-4	20-26	1.10-1.25	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37	4	4L	1-2
	4-24	28-35	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High	0.37			
	24-60	---	---	---	---	---	---	---	---			
DaB, DaD: Dailey	0-15	2-5	1.70-1.85	6.0-20	0.07-0.12	6.6-7.3	<2	Low	0.17	5	2	1-2
	15-60	2-5	1.75-1.95	6.0-20	0.04-0.07	6.6-8.4	<2	Low	0.17			
DrB: Duroc	0-5	15-25	1.20-1.40	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low	0.32	5	6	2-4
	5-35	18-27	1.20-1.40	0.6-2.0	0.15-0.17	6.6-7.8	<2	Low	0.32			
	35-60	18-27	1.30-1.45	0.6-2.0	0.15-0.17	7.9-9.0	<2	Low	0.32			
Du: Duroc	0-29	10-25	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.32	5	5	2-4
	29-60	10-25	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.32			
Go: Goshen	0-9	18-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low	0.32	5	6	2-4
	9-35	25-35	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43			
	35-60	15-27	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
Hm, HmB, HmC: Hemingford	0-10	10-20	1.25-1.40	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low	0.28	5	5	2-4
	10-25	25-35	1.15-1.25	0.2-0.6	0.15-0.19	6.6-8.4	<2	Moderate	0.32			
	25-42	10-25	1.25-1.40	0.2-2.0	0.12-0.19	7.4-8.4	<2	Moderate	0.32			
	42-60	---	---	---	---	---	---	---	---			
Ho: Hoffland	0-5	15-25	1.20-1.50	0.6-6.0	0.16-0.19	7.9-8.4	<2	Low	0.20	5	8	4-8
	5-42	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.15			
	42-51	10-20	1.30-1.50	2.0-6.0	0.14-0.16	6.6-8.4	<2	Low	0.20			
	51-60	1-10	1.40-1.70	6.0-20	0.06-0.11	6.6-8.4	<2	Low	0.15			
ImG*:												
Imlay	0-12	20-30	1.15-1.30	0.06-0.2	0.16-0.20	7.4-8.4	<4	Moderate	0.32	2	6	.5-1
	12-60	---	---	---	---	---	---	---	---			
Rock outcrop.												
IpB: Ipage	0-6	2-8	1.40-1.60	6.0-20	0.10-0.12	6.6-8.4	<2	Low	0.17	2	2	.5-1
	6-60	2-6	1.40-1.60	6.0-20	0.06-0.10	7.4-9.5	<4	Low	0.17			
JaB: Janise	0-15	2-10	1.40-1.60	2.0-20.0	0.10-0.12	>8.4	<4	Low	0.17	5	2	.5-1
	15-25	18-28	1.20-1.40	0.2-0.6	0.10-0.15	>8.4	2-8	Moderate	0.43			
	25-60	6-20	1.30-1.50	0.6-2.0	0.10-0.15	>8.4	2-8	Low	0.43			
JcB: Janise	0-18	2-8	1.50-1.70	6.0-20	0.10-0.12	6.6-9.0	<2	Low	0.17	5	2	.5-1
	18-29	15-28	1.20-1.40	0.2-0.6	0.10-0.15	>8.4	2-8	Moderate	0.43			
	29-60	6-18	1.10-1.30	0.6-2.0	0.10-0.15	>8.4	2-8	Low	0.43			
Jn: Janise	0-2	10-20	1.20-1.30	0.6-2.0	0.10-0.15	>8.4	2-8	Low	0.37	5	4L	1-2
	2-6	15-35	1.25-1.40	0.2-0.6	0.10-0.15	>9.0	>2	Moderate	0.37			
	6-60	10-25	1.30-1.40	0.6-2.0	0.10-0.15	>8.4	2-8	Low	0.37			
Jo: Janise	0-2	5-15	1.30-1.50	0.6-2.0	0.10-0.15	7.4-9.0	<4	Low	0.37	5	4L	1-2
	2-10	15-28	1.20-1.40	0.2-0.6	0.10-0.15	>8.4	>8	Moderate	0.43			
	10-60	6-18	1.15-1.30	0.6-2.0	0.10-0.15	>8.4	<4	Low	0.43			
JsB: Jayem	0-28	2-10	1.50-1.70	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.17	5	2	1-2
	28-38	10-25	1.20-1.40	2.0-6.0	0.15-0.17	6.6-8.4	<2	Low	0.43			
	38-60	5-18	1.40-1.60	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	0.43			
JxB: Jayem	0-14	3-8	1.50-1.70	2.0-6.0	0.08-0.14	6.6-7.8	<2	Low	0.17	5	2	1-2
	14-34	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.24			
	34-51	5-18	1.40-1.55	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.24			
	51-60	3-10	1.60-1.80	2.0-6.0	0.07-0.09	6.6-7.8	<2	Low	0.24			
JyB, JyC: Jayem	0-11	5-15	1.35-1.55	2.0-6.0	0.15-0.18	6.6-7.8	<2	Low	0.20	5	3	1-2
	11-26	5-18	1.40-1.55	2.0-6.0	0.15-0.17	6.6-7.8	<2	Low	0.43			
	26-60	5-18	1.50-1.70	2.0-6.0	0.15-0.17	6.6-7.8	<2	Low	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
Ke, KeB, KeC------ Keith	0-8	15-25	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low--------	0.32	5	6	2-3
	8-36	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.32			
	36-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43			
Lc--------------- Lamo Variant	0-5	8-18	1.30-1.50	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	5	4L	2-3
	5-37	10-18	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low--------	0.32			
	37-60	6-18	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Ln*:												
Las Animas-------	0-9	8-18	1.40-1.55	2.0-6.0	0.16-0.20	7.4-8.4	<4	Low--------	0.37	5	3	1-2
	9-42	8-18	1.50-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low--------	0.37			
	42-60	0-5	1.50-1.70	6.0-20	0.06-0.08	7.4-8.4	<2	Low--------	0.15			
Lisco------------	0-5	5-15	1.30-1.40	0.6-2.0	0.10-0.15	6.1-9.5	<4	Low--------	0.37	5	3	1-2
	5-10	5-18	1.30-1.40	2.0-6.0	0.10-0.15	>8.4	<4	Low--------	0.43			
	10-40	5-15	1.40-1.50	2.0-6.0	0.10-0.15	>8.4	>8	Low--------	0.24			
	40-60	3-10	1.50-1.60	2.0-20	0.05-0.14	>7.8	<4	Low--------	0.24			
Lo--------------- Lisco	0-5	5-15	1.30-1.40	0.6-2.0	0.10-0.15	6.1-9.5	<4	Low--------	0.37	5	3	1-2
	5-18	5-18	1.30-1.40	2.0-6.0	0.10-0.15	>8.4	<4	Low--------	0.43			
	18-60	5-15	1.40-1.50	2.0-6.0	0.10-0.15	>8.4	>8	Low--------	0.24			
Lp--------------- Lisco	0-4	7-15	1.30-1.40	0.6-2.0	0.10-0.15	7.4-9.0	<2	Low--------	0.37	5	3	1-2
	4-15	5-15	1.30-1.50	0.6-6.0	0.10-0.15	7.4-9.0	<2	Low--------	0.37			
	15-60	3-10	1.35-1.50	2.0-6.0	0.08-0.15	>7.8	<4	Low--------	0.24			
MaB*, MaC*:												
Manter-----------	0-12	10-20	1.30-1.50	2.0-6.0	0.12-0.16	6.1-7.8	<2	Low--------	0.20	5	3	1-2
	12-34	9-18	1.40-1.55	2.0-20	0.11-0.14	6.1-7.8	<2	Low--------	0.24			
	34-60	5-15	1.50-1.70	2.0-20	0.08-0.14	7.9-8.4	<2	Low--------	0.17			
Satanta----------	0-16	5-12	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low--------	0.20	5	3	1-2
	16-31	18-28	1.35-1.45	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	31-60	7-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
Mc--------------- Marlake	0-13	5-15	1.40-1.50	2.0-6.0	0.16-0.18	6.6-8.4	<2	Low--------	0.28	2	3	4-8
	13-20	3-8	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low--------	0.17			
	20-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.6-7.8	<2	Low--------	0.17			
Md--------------- McCook	0-12	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	12-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low--------	0.43			
NoD, NoF--------- Norrest	0-4	20-26	1.10-1.25	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37	4	4L	1-2
	4-21	28-35	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High-------	0.37			
	21-60	---	---	---	---	---	---	-----------	----			
NpF*:												
Norrest----------	0-4	20-26	1.10-1.25	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37	4	4L	1-2
	4-22	28-35	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High-------	0.37			
	22-60	---	---	---	---	---	---	-----------	----			
Canyon-----------	0-7	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.37	2	4L	.5-1
	7-15	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	15-60	---	---	---	---	---	---	-----------	----			
OtD*, OtF*:												
Oglala-----------	0-8	8-18	1.15-1.25	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.32	5	3	1-2
	8-53	5-18	1.25-1.40	0.6-2.0	0.15-0.20	6.6-8.4	<2	Low--------	0.43			
	53-60	---	---	---	---	---	---	-----------	----			
Canyon-----------	0-11	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.37	2	4L	.5-1
	11-18	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	18-60	---	---	---	---	---	---	-----------	----			
Rh--------------- Richfield	0-8	10-24	1.30-1.40	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	8-26	35-40	1.35-1.50	0.2-0.6	0.14-0.19	6.6-8.4	<2	High-------	0.43			
	26-60	18-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-9.0	<2	Moderate	0.43			
RkG*: Rock outcrop.												

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
RkG*:												
Tassel----------	0-3	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	2	2	.5-1
	3-12	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.24			
	12-60	---	---	---	---	---	---	----------	----			
Ro, RoB---------- Rosebud	0-7	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low--------	0.28	4	6	2-4
	7-24	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-7.8	<2	Moderate	0.28			
	24-35	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low--------	0.28			
	35-60	---	---	---	---	---	---	----------	----			
RsD*, RsF*:												
Rosebud---------	0-7	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low--------	0.28	4	6	2-4
	7-24	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-7.8	<2	Moderate	0.28			
	24-35	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low--------	0.28			
	35-60	---	---	---	---	---	---	----------	----			
Canyon----------	0-10	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.37	2	4L	.5-1
	10-18	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	18-60	---	---	---	---	---	---	----------	----			
SbB*:												
Sarben----------	0-6	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.24	5	2	.5-1
	6-15	10-18	1.20-1.40	2.0-6.0	0.16-0.18	6.6-7.3	<2	Low--------	0.24			
	15-60	10-18	1.20-1.40	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.24			
Busher----------	0-3	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low--------	0.20	5	2	1-2
	3-40	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low--------	0.20			
	40-60	---	---	---	---	---	---	----------	----			
SbD*:												
Sarben----------	0-3	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.24	5	2	.5-1
	3-15	10-18	1.20-1.40	2.0-6.0	0.16-0.18	6.6-7.3	<2	Low--------	0.24			
	15-60	10-18	1.20-1.40	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.24			
Busher----------	0-3	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low--------	0.20	5	2	1-2
	3-40	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low--------	0.20			
	40-60	---	---	---	---	---	---	----------	----			
StB, StC, StD---- Satanta	0-13	5-12	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low--------	0.20	5	3	1-2
	13-31	18-28	1.35-1.45	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	31-60	7-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
Su--------------- Scott Variant	0-9	8-18	1.30-1.50	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low--------	0.37	3	5	1-2
	9-22	34-50	1.25-1.40	<0.06	0.10-0.14	5.6-7.8	<2	High-------	0.37			
	22-41	8-20	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.37			
	41-60	---	---	---	---	---	---	----------	----			
TaF--------------- Tassel	0-7	5-12	1.50-1.75	2.0-6.0	0.16-0.18	7.4-8.4	<2	Low--------	0.24	2	2	.5-1
	7-18	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.24			
	18-60	---	---	---	---	---	---	----------	----			
VaD, VaE--------- Valent	0-4	3-10	1.70-1.90	6.0-20	0.07-0.12	6.6-7.3	<2	Low--------	0.15	5	1	.5-1
	4-60	2-8	1.70-1.90	6.0-20	0.05-0.10	6.6-7.3	<2	Low--------	0.15			
VdB, VdD, VdE---- Valent	0-5	3-10	1.60-1.85	6.0-20	0.07-0.12	6.6-7.8	<2	Low--------	0.17	5	1	.5-1
	5-60	2-8	1.70-1.90	6.0-20	0.05-0.17	6.6-7.8	<2	Low--------	0.17			
VnD, VnE, VnF---- Valentine	0-3	0-6	1.70-1.90	6.0-20	0.07-0.09	6.1-7.3	<2	Low--------	0.15	5	1	.5-1
	3-60	0-8	1.70-1.90	6.0-20	0.05-0.11	6.1-7.3	<2	Low--------	0.15			
VtB, VtC--------- Vetal	0-10	10-18	1.25-1.35	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low--------	0.20	5	3	1-2
	10-36	12-18	1.25-1.40	2.0-6.0	0.11-0.19	6.6-7.8	<2	Low--------	0.20			
	36-60	10-18	1.30-1.40	2.0-6.0	0.10-0.17	6.6-8.4	<2	Low--------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ac, AcB, AcC------ Alliance	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
ArB*, ArC*, ArD*:												
Alliance---------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
Rosebud----------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
Ba--------------- Bankard	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low------	Moderate	Low.
BbB-------------- Bankard	A	Occasional	Brief-----	Mar-Jun	>6.0	---	---	>60	---	Low------	Moderate	Low.
Br--------------- Bridget	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
BrB, BrC--------- Bridget	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
BuB*, BuC*, BuD*:												
Busher-----------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Low------	Moderate	Low.
Jayem------------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
BvC*, BvF*:												
Busher-----------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Low------	Low------	Low.
Tassel-----------	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
CaF-------------- Canyon	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
CbB-------------- Craft	B	Occasional	Brief-----	Mar-Jun	>6.0	---	---	>60	---	Low------	High-----	Low.
Ce, CeB, CeC, CeD- Creighton	B	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
CnD*, CnF*:												
Creighton--------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Norrest----------	C	None---------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
DaB, DaD--------- Dailey	A	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
DrB-------------- Duroc	B	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
Du Duroc	B	Occasional	Very brief	Mar-Jul	>6.0	---	---	>60	---	Moderate	High	Low.
Go Goshen	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Hm, HmB, HmC Hemingford	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	High	Low.
Ho** Hoffland	D	None	---	---	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
ImG*: Imlay	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	Low.
Rock outcrop.												
IpB Ipage	A	Rare	---	---	3.0-6.0	Apparent	Feb-Jun	>60	---	Moderate	Moderate	Moderate.
JaB Janise	C	Rare	---	---	2.0-4.0	Apparent	Feb-Jun	>60	---	Moderate	High	High.
JcB Janise	B	Rare	---	---	>6.0	---	---	>60	---	Low	High	High.
Jn Janise	C	Rare	---	---	2.0-3.0	Apparent	Dec-Jul	>60	---	High	High	High.
Jo Janise	C	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	High.
JsB, JxB, JyB, JyC Jayem	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Ke, KeB, KeC Keith	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Lc** Lamo Variant	C	Occasional	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	Moderate	High	Moderate.
Ln*: Las Animas	B/D	Occasional	Brief	Mar-Aug	1.5-3.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
Lisco	C	Occasional	Brief	Mar-Jun	1.5-3.5	Apparent	Feb-May	>60	---	Moderate	High	High.
Lo Lisco	C	Occasional	Brief	Feb-Jun	1.5-3.5	Apparent	Feb-May	>60	---	Moderate	High	High.
Lp** Lisco	C	Occasional	Brief	Feb-Jun	+.5-1.5	Apparent	Mar-Jun	>60	---	Moderate	High	Moderate.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
MaB*, MaC*:												
Manter	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Mc** Marlake	D	None	---	---	+2-1.0	Apparent	Oct-Jun	>60	---	Moderate	High	Low.
Md McCook	B	Occasional	Very brief	Mar-Jul	>6.0	---	---	>60	---	Moderate	Moderate	Low.
NoD, NoF Norrest	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
NpF*:												
Norrest	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
OtD*, OtF*:												
Oglala	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Rh Richfield	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
RkG*:												
Rock outcrop.												
Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Ro, RoB Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
RsD*, RsF*:												
Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
SbB*, SbD*:												
Sarben	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Busher	B	None	---	---	>6.0	---	---	40-60	Soft	Low	Moderate	Low.
StB, StC, StD Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Su** Scott Variant	D	None	---	---	+1-1.0	Perched	Mar-Jun	40-72	Soft	High	High	Moderate.
TaF Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
VaD, VaE, VdB, VdD, VdE--------- Valent	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
VnD, VnE, VnF----- Valentine	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
VtB, VtC---------- Vetal	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

** A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water is above the surface. The second numeral indicates the depth below the surface.

TABLE 19.--ENGINEERING INDEX TEST DATA

[NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit	Plasticity index	Specific gravity
			Percentage passing sieve--					Percentage smaller than--					
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
											Pct		G/cm^3
Alliance loam: (S77NE-013-004)													
Ap------ 00 to 05	A-4 (08)	CL	100	100	100	99	77	58	25	19	29	10	2.60
Bt------ 08 to 16	A-7-6(14)	CL	100	100	100	100	90	78	39	31	45	22	2.69
C1------ 20 to 34	A-4 (08)	CL-ML	100	100	100	99	76	53	17	10	26	5	2.65
Creighton very fine sandy loam: (S77NE-013-002)													
Ap------ 00 to 05	A-4 (05)	ML	100	100	100	99	59	37	13	9	NP	NP	2.60
Bw1----- 09 to 17	A-4 (03)	SM	100	100	100	99	49	32	12	9	NP	NP	2.62
C2------ 31 to 60	A-4 (02)	SM	100	100	100	98	45	25	8	6	NP	NP	2.61
Dailey loamy sand: (S77NE-013-007)													
Ap------ 00 to 07	A-2-4(00)	SM	100	100	100	91	29	17	5	4	NP	NP	2.63
C------- 15 to 60	A-2-4(00)	SM	100	100	100	93	26	16	6	5	NP	NP	2.64
Janise loam, drained: (S77NE-013-008)													
E------- 00 to 02	A-4 (08)	ML	100	100	100	99	80	66	17	10	31	4	2.54
Bw------ 02 to 06	A-4 (08)	CL	100	100	100	100	86	75	25	16	32	10	2.58
C1------ 10 to 44	A-4 (05)	ML	100	100	100	99	60	37	13	9	21	4	2.64
Norrest loam: (S77NE-013-003)													
A------- 00 to 04	A-4 (08)	ML	99	97	96	91	73	57	14	7	37	10	2.57
Bw2----- 08 to 21	A-7-6(21)	CH	100	100	100	98	88	79	53	42	58	34	2.68
Cr------ 21 to 60	A-7-6(22)	CH	98	96	95	94	86	79	51	42	61	34	2.69
Sarben loamy very fine sand: (S77NE-013-001)													
A1------ 00 to 03	A-4 (06)	ML	100	100	100	100	63	29	9	6	26	NP	2.59
AC------ 03 to 12	A-4 (06)	ML	100	100	100	100	63	25	9	6	23	NP	2.60
C1------ 12 to 25	A-4 (06)	ML	100	100	100	100	64	27	7	5	NP	NP	2.61
Satanta fine sandy loam: (S77NE-013-009)													
Ap------ 00 to 07	A-4 (01)	SM	100	100	100	98	39	25	9	7	17	1	2.62
Bt------ 13 to 24	A-4 (06)	CL	100	100	100	99	66	53	21	15	29	10	2.68
C1------ 31 to 46	A-4 (08)	CL-ML	100	100	100	100	85	71	22	13	29	7	2.67

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution								Liquid limit	Plasticity index	Specific gravity
			Percentage passing sieve--					Percentage smaller than--					
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
											Pct		G/cm^3
Tassel loamy very fine sand: (S77NE-013-006)													
A-------- 00 to 07	A-4 (04)	ML	98	98	98	95	53	26	7	4	24	1	2.60
C-------- 07 to 18	A-4 (05)	ML	98	97	97	92	58	34	9	5	29	1	2.57

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alliance	Fine-silty, mixed, mesic Aridic Argiustolls
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Bridget	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Busher	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Craft	Coarse-silty, mixed (calcareous), mesic Ustic Torrifluvents
Creighton	Coarse-loamy, mixed, mesic Aridic Haplustolls
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
Duroc	Fine-silty, mixed, mesic Pachic Haplustolls
*Goshen	Fine-silty, mixed, mesic Pachic Argiustolls
Hemingford	Fine-loamy, mixed, mesic Aridic Argiustolls
Hoffland	Sandy, mesic Typic Calciaquolls
*Imlay	Loamy-skeletal, mixed (calcareous), mesic, shallow Ustic Torriorthents
Ipage	Mixed, mesic Aquic Ustipsamments
Janise	Coarse-silty, mixed (calcareous), mesic Typic Halaquepts
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Lamo Variant	Coarse-loamy, mixed (calcareous), mesic Cumulic Haplaquolls
Las Animas	Coarse-loamy, mixed (calcareous), mesic Typic Fluvaquents
Lisco	Coarse-loamy, mixed (calcareous), mesic Typic Halaquepts
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Marlake	Sandy, mixed, mesic Mollic Fluvaquents
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
*Norrest	Fine, montmorillonitic, mesic Ustollic Haplargids
*Oglala	Coarse-silty, mixed, mesic Aridic Haplustolls
Richfield	Fine, montmorillonitic, mesic Aridic Argiustolls
Rosebud	Fine-loamy, mixed, mesic Aridic Argiustolls
Sarben	Coarse-loamy, mixed, nonacid, mesic Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Scott Variant	Fine, montmorillonitic, mesic Typic Argialbolls
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Valent	Mixed, mesic Ustic Torripsamments
Valentine	Mixed, mesic Typic Ustipsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls

* The soil is a taxadjunct to the series. See text for description of those characteristics of the soil that are outside the range of the series.

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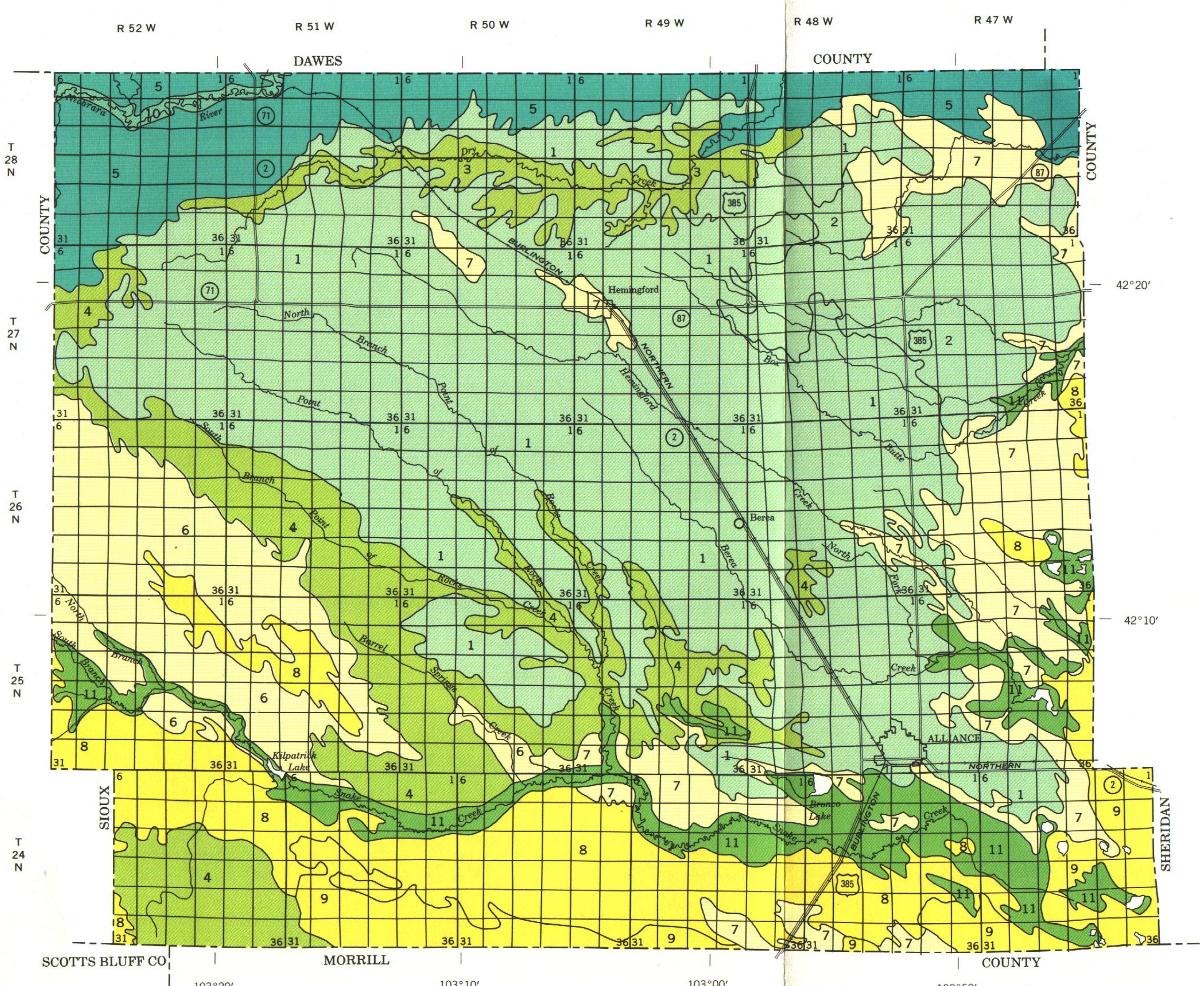
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

BOX BUTTE COUNTY, NEBRASKA



Scale 1: 253,440

1 0 1 2 3 4 Miles

1 0 1 2 3 4 5 6 Kilometers

SOIL LEGEND*

LOAMY, DEEP AND MODERATELY DEEP SOILS; ON UPLANDS

1 Alliance-Rosebud-Keith association: Deep and moderately deep, nearly level to steep, well drained, loamy soils; on uplands

2 Alliance-Hemingford-Satanta association: Deep, nearly level to strongly sloping, well drained, loamy soils; on uplands

LOAMY, DEEP, MODERATELY DEEP, AND SHALLOW SOILS; ON UPLANDS

3 Norrest-Canyon-Creighton association: Deep, moderately deep, and shallow, gently sloping to steep, well drained, loamy soils; on uplands

4 Creighton-Oglala-Canyon association: Deep and shallow, nearly level to steep, well drained, loamy soils; on uplands

SANDY, DEEP AND SHALLOW SOILS; ON UPLANDS

5 Busher-Valent-Tassel association: Deep and shallow, nearly level to very steep, well drained and excessively drained, sandy soils; on uplands

LOAMY AND SANDY, DEEP SOILS; ON UPLANDS

6 Sarben-Busher association: Deep, nearly level to strongly sloping, well drained, sandy soils; on uplands

7 Satanta-Jayem-Busher association: Deep, nearly level to strongly sloping, well drained, loamy and sandy soils; on uplands

SANDY, DEEP SOILS; ON UPLANDS AND SANDHILLS

8 Valent-Dailey association: Deep, nearly level to moderately steep, excessively drained and somewhat excessively drained, sandy soils; on uplands

9 Valentine association: Deep, gently sloping to very steep, excessively drained, sandy soils; on sandhills

LOAMY, DEEP SOILS; ON BOTTOM LANDS

10 Las Animas-Lisco association: Deep, nearly level, somewhat poorly drained and poorly drained, loamy soils; on bottom lands

LOAMY AND SANDY, DEEP, SALINE-ALKALI SOILS; ON BOTTOM LANDS

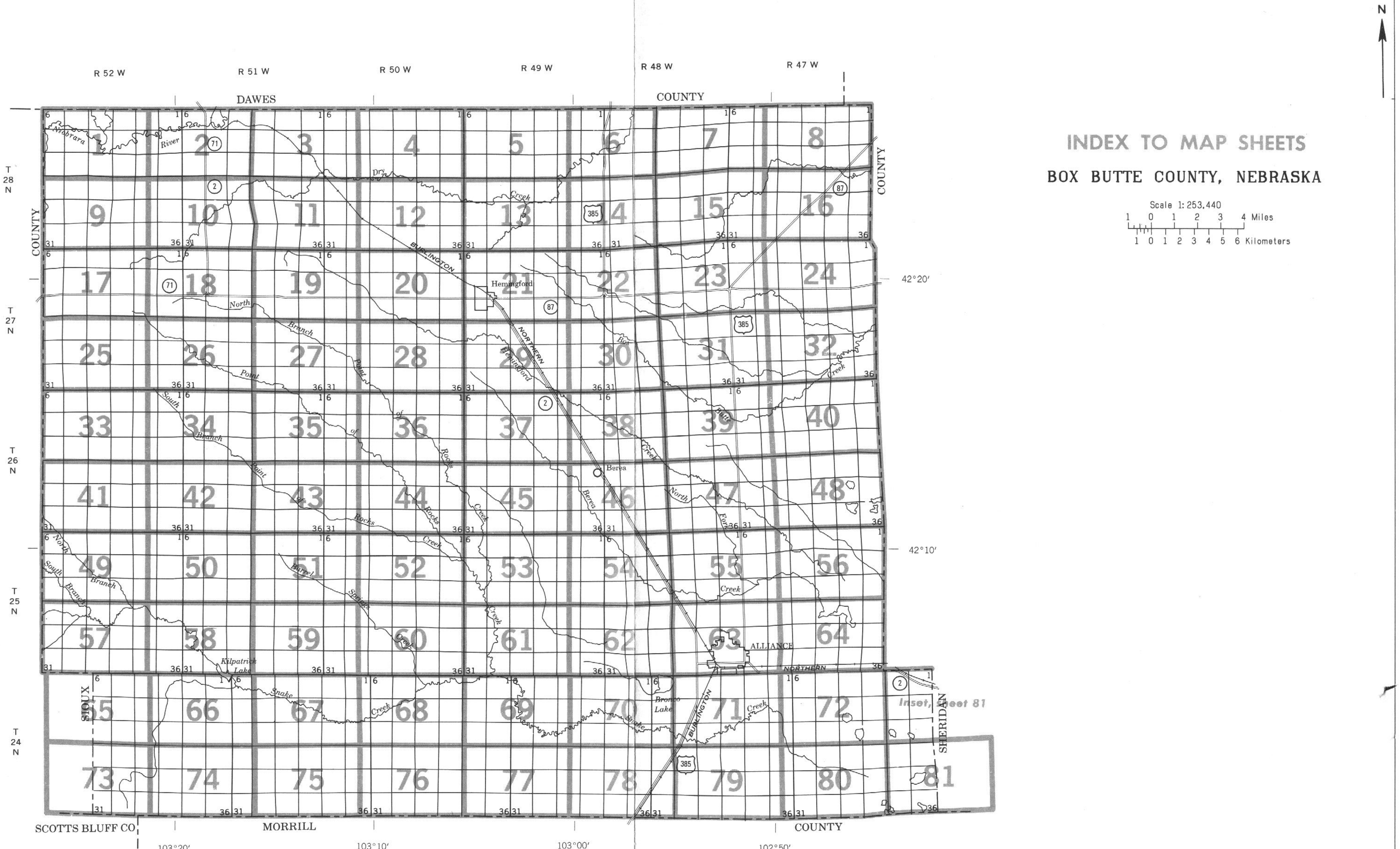
11 Janise-Lisco association: Deep, nearly level and very gently sloping, moderately well drained, somewhat poorly drained, and poorly drained, loamy and sandy, saline-alkali soils; on bottom lands

*Texture terms refer to the surface layer of the major soils.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County
- Reservation (national forest or park, state forest or park, and large airport)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

DAMS

- Medium or small — water, w

PITS

- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Located object (label) — Tower
- Windmill

WATER FEATURES

DRAINAGE

- Perennial, single line
- Intermittent
- Drainage end

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — AcB, ArC

SHORT STEEP SLOPE

DEPRESSION OR SINK

MISCELLANEOUS

- Blowout
- Clay spot
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Land leveled areas

SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate slope phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils.

SYMBOL	NAME	SYMBOL	NAME
Ac	Alliance loam, 0 to 1 percent slopes	JyB	Jayem fine sandy loam, 0 to 3 percent slopes
AcB	Alliance loam, 1 to 3 percent slopes	JyC	Jayem fine sandy loam, 3 to 6 percent slopes
AcC	Alliance loam, 3 to 6 percent slopes	Ke	Keith loam, 0 to 1 percent slopes
ArB	Alliance-Rosebud loams, 1 to 3 percent slopes	KeB	Keith loam, 1 to 3 percent slopes
ArC	Alliance-Rosebud loams, 3 to 6 percent slopes	KeC	Keith loam, 3 to 6 percent slopes
ArD	Alliance-Rosebud loams, 6 to 11 percent slopes	Lc	Lamo Variant loam, 0 to 1 percent slopes
Ba	Bankard fine sand, 0 to 2 percent slopes	Ln	Las Animas-Lisco very fine sandy loams, 0 to 2 percent slopes
BbB	Bankard very fine sandy loam, 0 to 3 percent slopes	Lo	Lisco very fine sandy loam, 0 to 2 percent slopes
Br	Bridget very fine sandy loam, 0 to 1 percent slopes	Lp	Lisco very fine sandy loam, wet, 0 to 1 percent slopes
BrB	Bridget very fine sandy loam, 1 to 3 percent slopes	MaB	Manter-Satanta fine sandy loams, 0 to 3 percent slopes
BrC	Bridget very fine sandy loam, 3 to 6 percent slopes	MaC	Manter-Satanta fine sandy loams, 3 to 6 percent slopes
BuB	Busher-Jayem loamy very fine sands, 0 to 3 percent slopes	Mc	Marlake very fine sandy loam, 0 to 1 percent slopes
BuC	Busher-Jayem loamy very fine sands, 3 to 6 percent slopes	Md	McCook loam, 0 to 2 percent slopes
BuD	Busher-Jayem loamy very fine sands, 6 to 9 percent slopes	NoD	Norrest loam, 6 to 11 percent slopes
BvC	Busher-Tassel loamy very fine sands, 0 to 6 percent slopes	NoF	Norrest loam, 11 to 30 percent slopes
BvF	Busher-Tassel loamy very fine sands, 6 to 30 percent slopes	NpF	Norrest-Canyon complex, 11 to 30 percent slopes
CaF	Canyon very fine sandy loam, 3 to 30 percent slopes	OtD	Oglala-Canyon very fine sandy loams, 3 to 9 percent slopes
CbB	Craft very fine sandy loam, 0 to 3 percent slopes	OtF	Oglala-Canyon very fine sandy loams, 9 to 30 percent slopes
Ce	Creighton very fine sandy loam, 0 to 1 percent slopes	Rh	Richfield loam, 0 to 1 percent slopes
CeB	Creighton very fine sandy loam, 1 to 3 percent slopes	RkG	Rock outcrop-Tassel complex, 11 to 60 percent slopes
CeC	Creighton very fine sandy loam, 3 to 6 percent slopes	Ro	Rosebud loam, 0 to 1 percent slopes
CeD	Creighton very fine sandy loam, 6 to 11 percent slopes	RoB	Rosebud loam, 1 to 3 percent slopes
CnD	Creighton-Norrest complex, 6 to 11 percent slopes	RsD	Rosebud-Canyon complex, 3 to 9 percent slopes
CnF	Creighton-Norrest complex, 11 to 30 percent slopes	RsF	Rosebud-Canyon complex, 9 to 30 percent slopes
DaB	Dailey loamy sand, 0 to 3 percent slopes	SbB	Sarben-Busher loamy very fine sands, 0 to 3 percent slopes
DaD	Dailey loamy sand, 3 to 9 percent slopes	SbD	Sarben-Busher loamy very fine sands, 3 to 9 percent slopes
DrB	Duroc loam, 1 to 3 percent slopes	StB	Satanta fine sandy loam, 0 to 3 percent slopes
Du	Duroc loam, occasionally flooded, 0 to 2 percent slopes	StC	Satanta fine sandy loam, 3 to 6 percent slopes
Go	Goshen loam, 0 to 1 percent slopes	StD	Satanta fine sandy loam, 6 to 9 percent slopes
Hm	Hemingford loam, 0 to 1 percent slopes	Su	Scott Variant loam, 0 to 1 percent slopes
HmB	Hemingford loam, 1 to 3 percent slopes	TaF	Tassel loamy very fine sand, 3 to 30 percent slopes
HmC	Hemingford loam, 3 to 6 percent slopes	VaD	Valent fine sand, 3 to 9 percent slopes
Ho	Hoffland find sandy loam, wet, 0 to 1 percent slopes	VaE	Valent fine sand, 9 to 17 percent slopes
ImG	Imlay-Rock outcrop complex, 11 to 60 percent slopes	VdB	Valent loamy fine sand, 0 to 3 percent slopes
IpB	Ipage loamy fine sand, alkali substratum, 0 to 3 percent slopes	VdD	Valent loamy fine sand, 3 to 9 percent slopes
JaB	Janise loamy fine sand, overblown, 0 to 3 percent slopes	VdE	Valent loamy fine sand, 9 to 17 percent slopes
JcB	Janise loamy fine sand, drained, overblown, 0 to 3 percent slopes	VnD	Valentine fine sand, 3 to 9 percent slopes
Jn	Janise loam, 0 to 2 percent slopes	VnE	Valentine fine sand, 9 to 17 percent slopes
Jo	Janise loam, drained, 0 to 2 percent slopes	VnF	Valentine fine sand, hilly
JsB	Jayem loamy sand, overblown, 0 to 3 percent slopes	VtB	Vetal fine sandy loam, 0 to 3 percent slopes
JxB	Jayem loamy fine sand, 0 to 3 percent slopes	VtC	Vetal fine sandy loam, 3 to 6 percent slopes

BOX BUTTE COUNTY, NEBRASKA NO. 1

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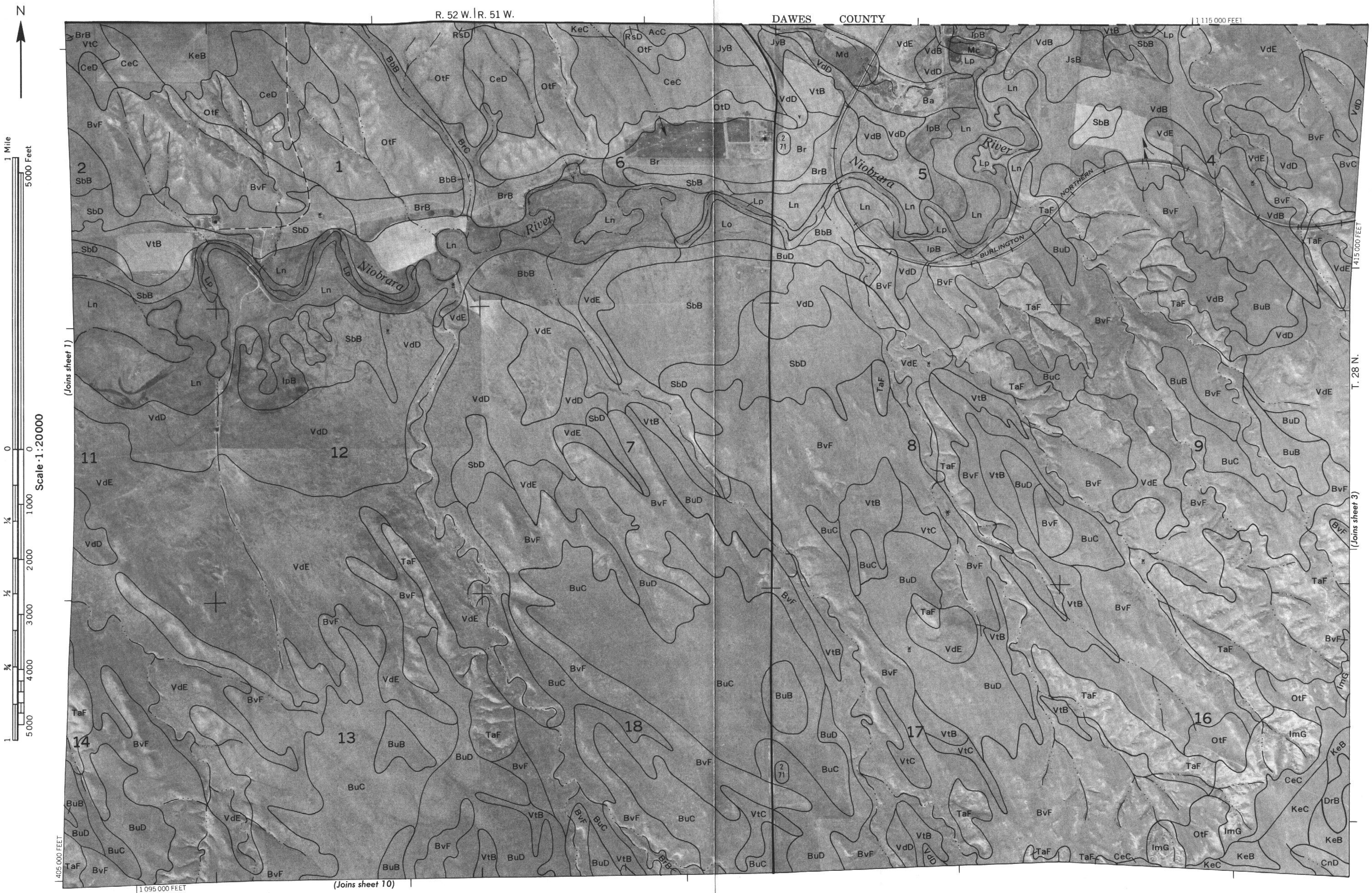

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BOX BUTTE COUNTY, NEBRASKA NO. 3

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BOX BUTTE COUNTY, NEBRASKA NO. 5

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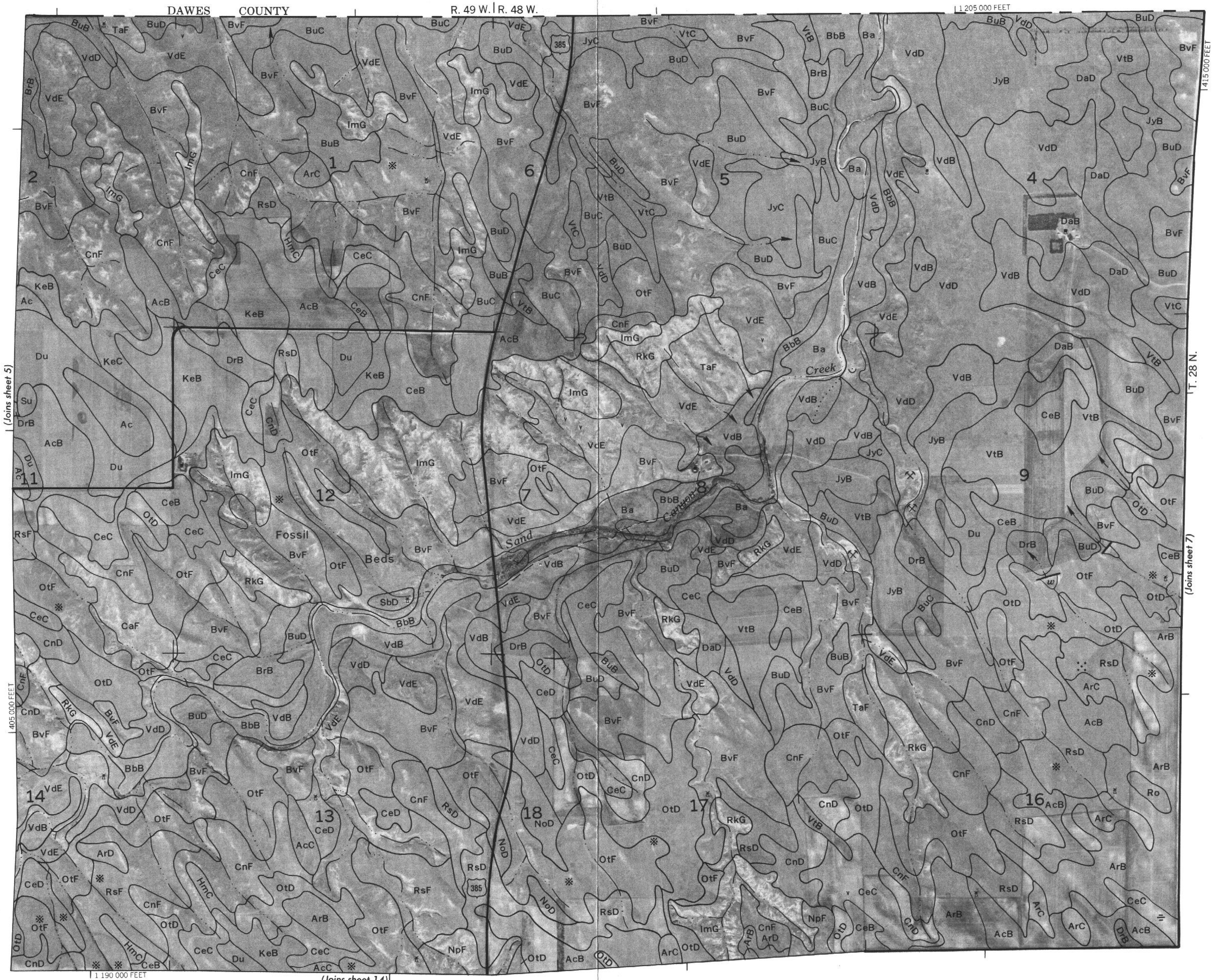
6

N



Scale 1:20 000

1 Mile
5000 Feet
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

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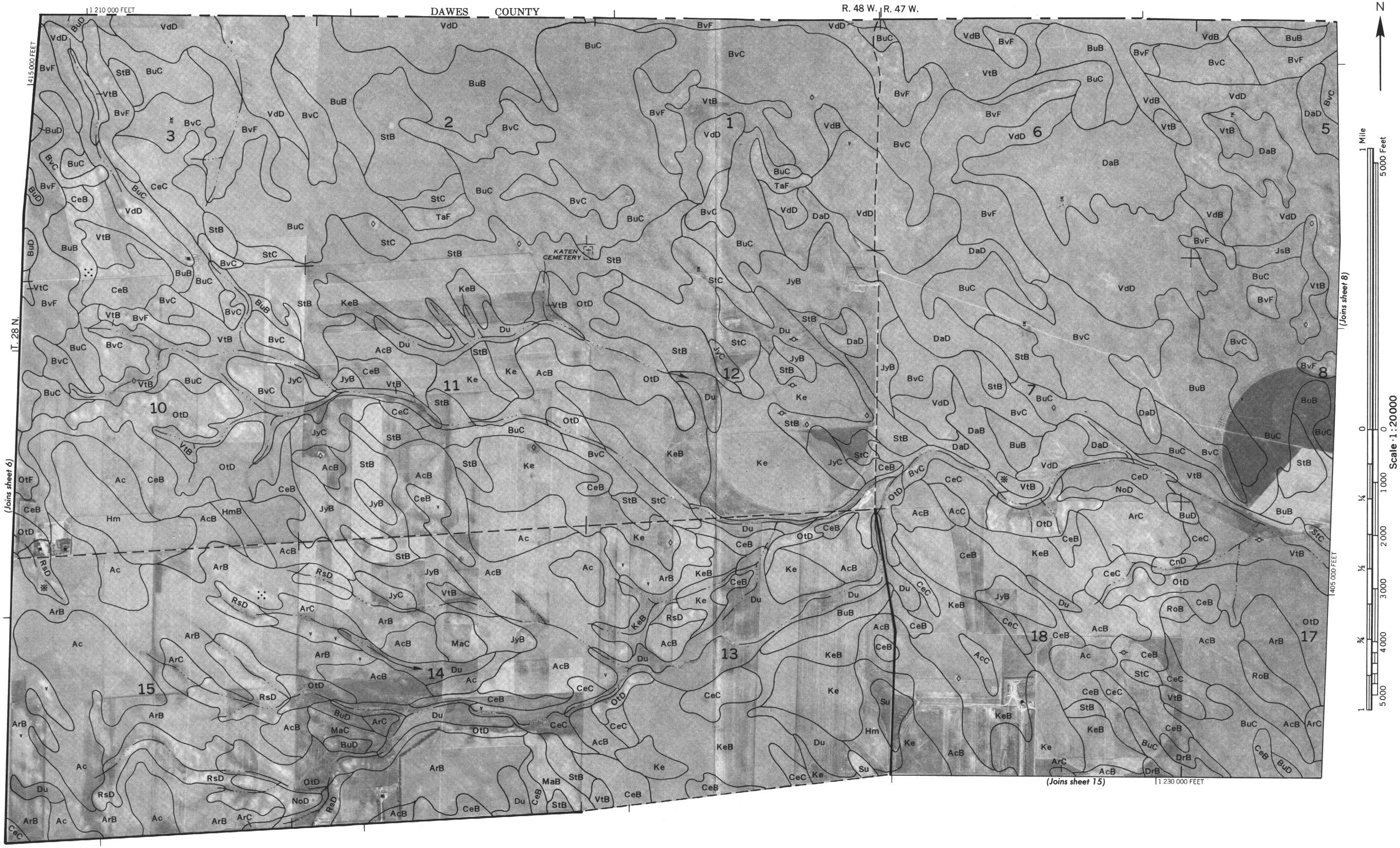
7



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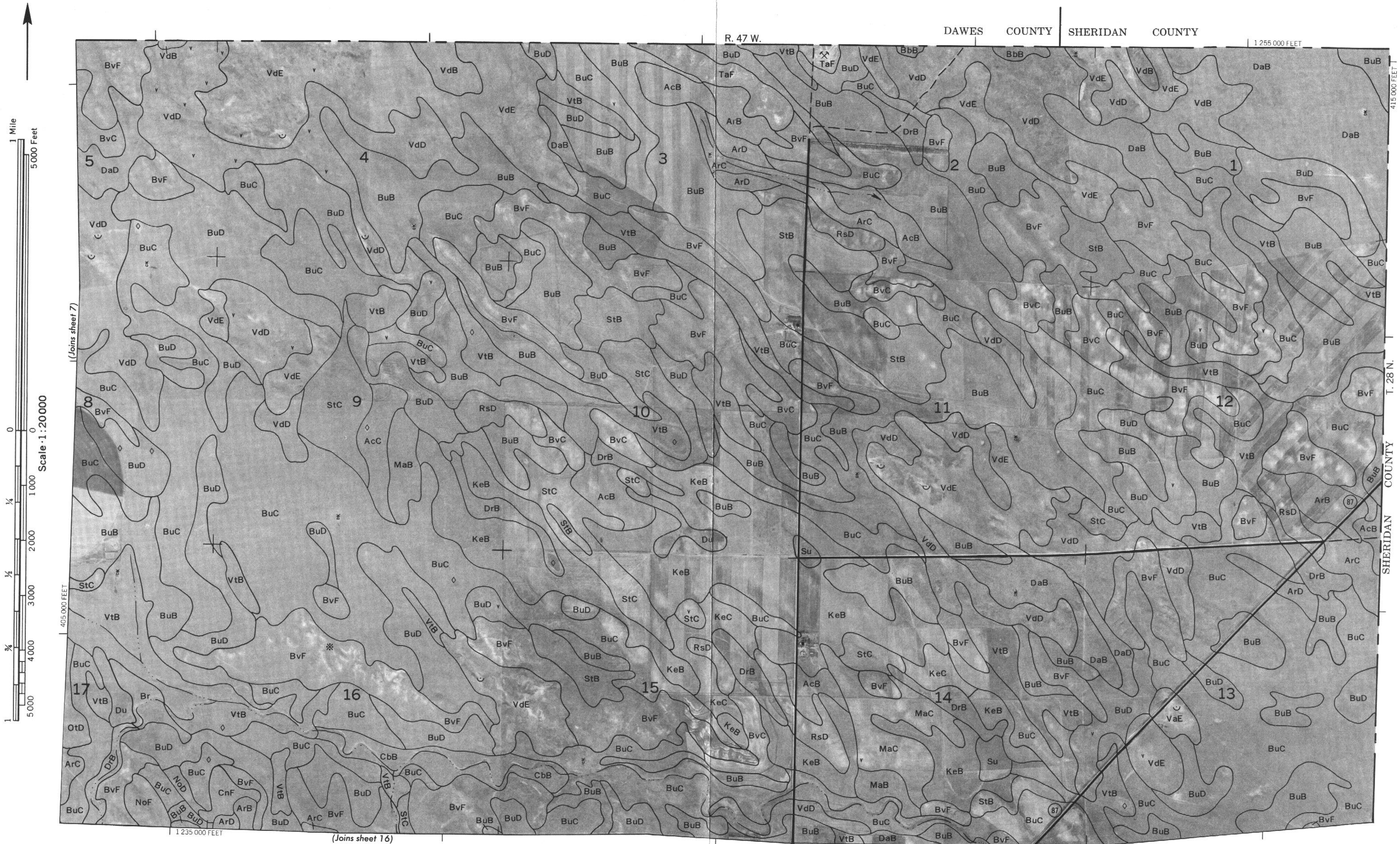

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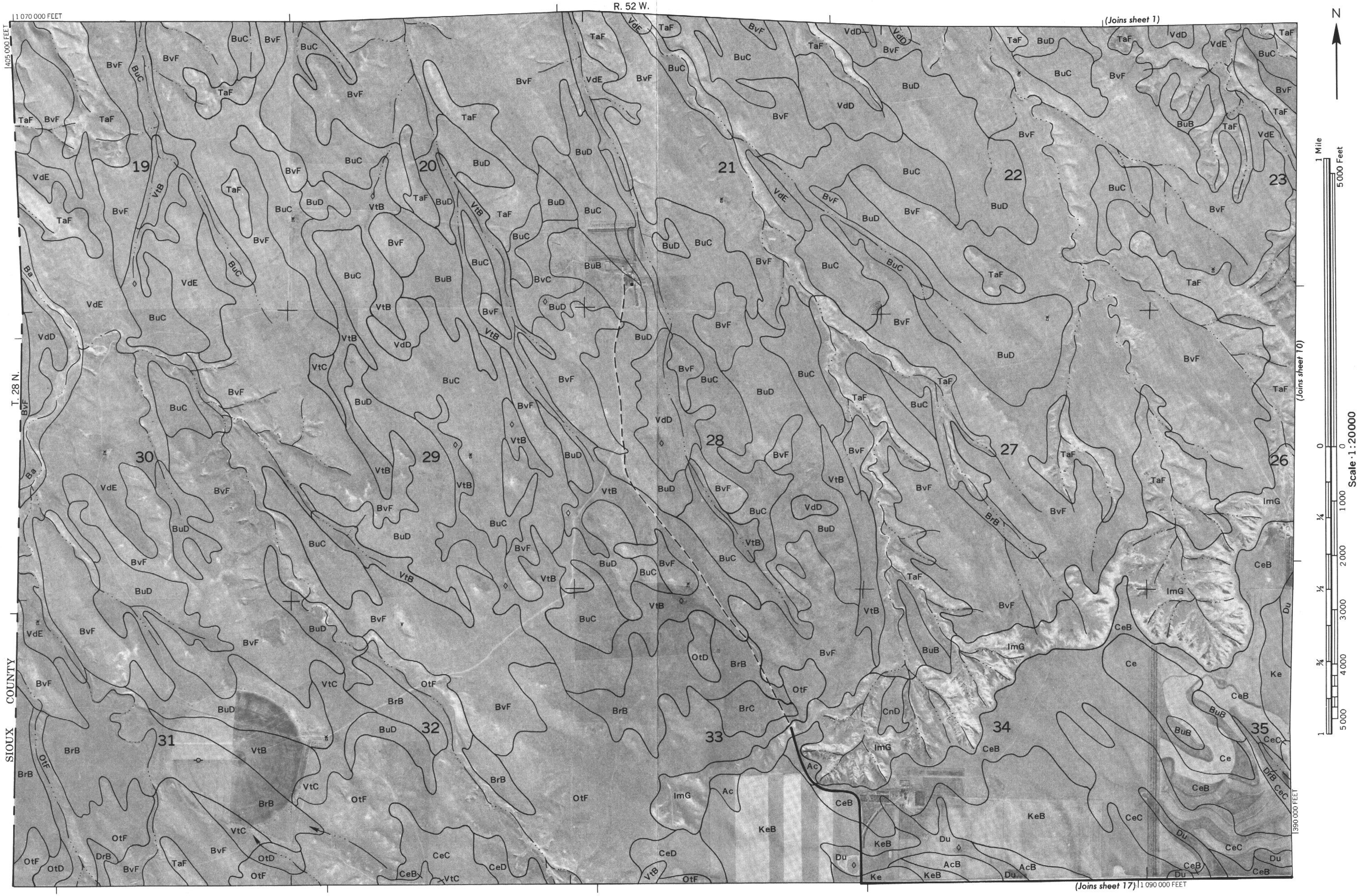

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BOX BUTTE COUNTY, NEBRASKA NO. 9

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 10

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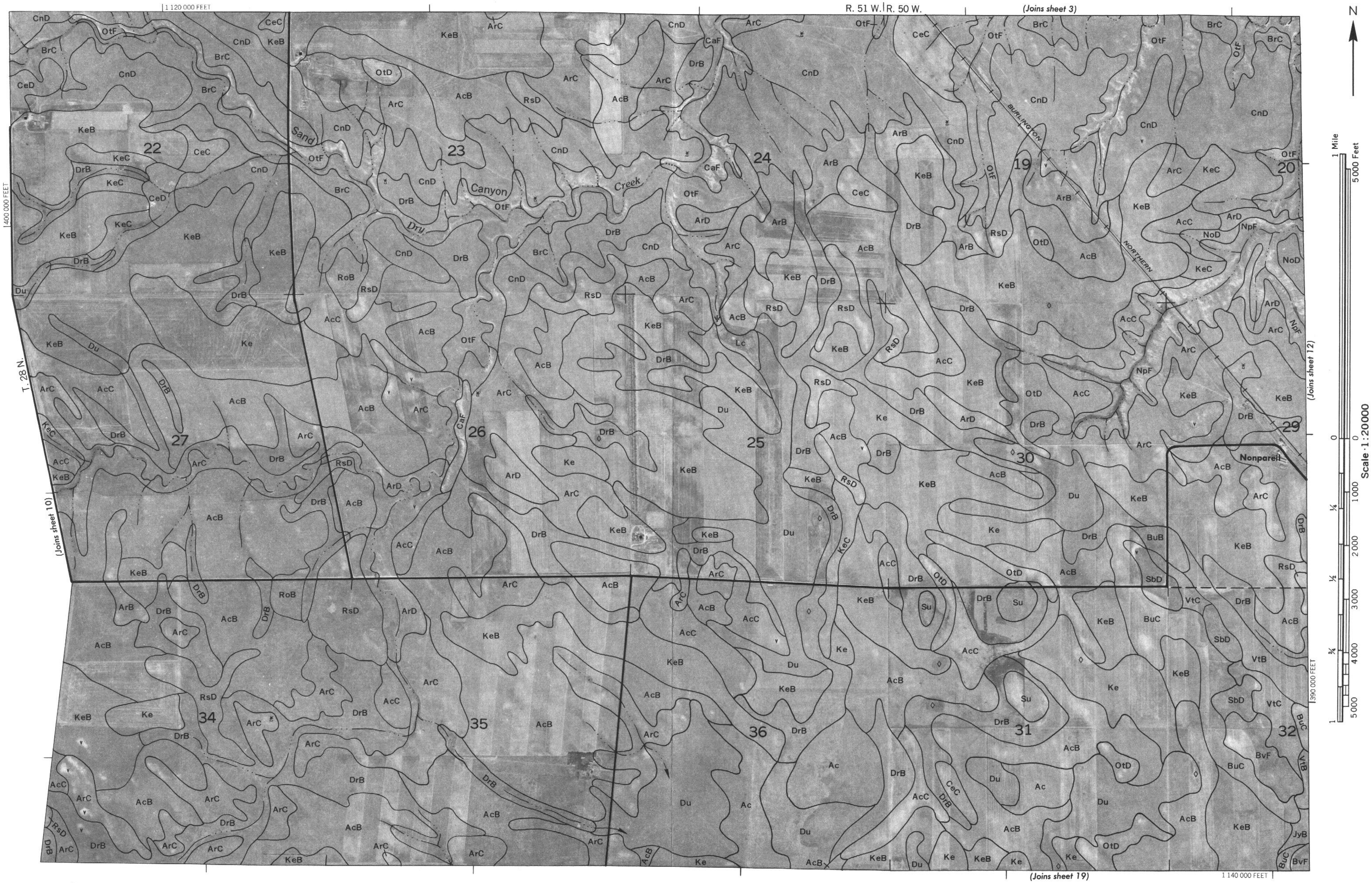

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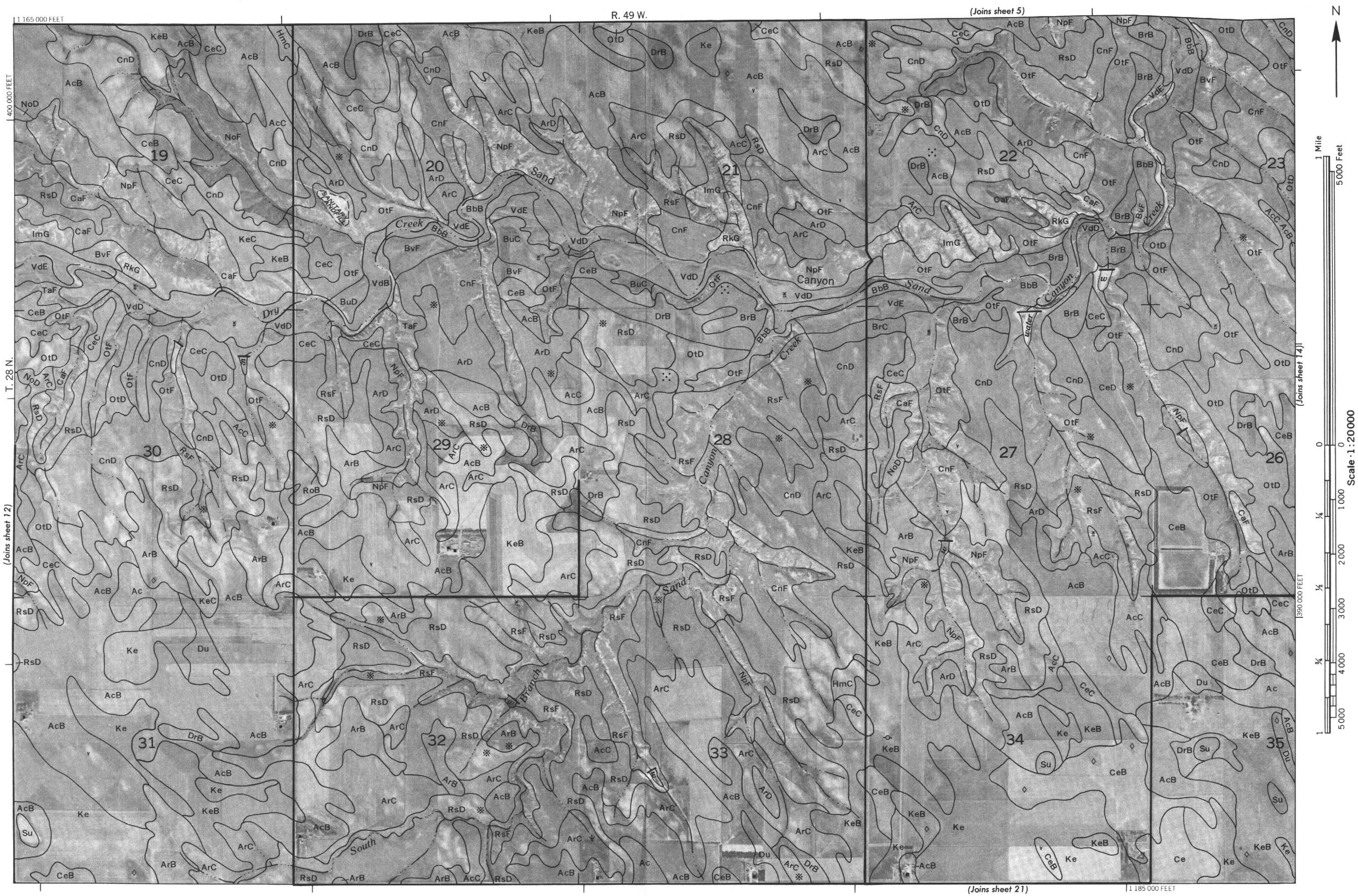

BOX BUTTE COUNTY, NEBRASKA NO. 13

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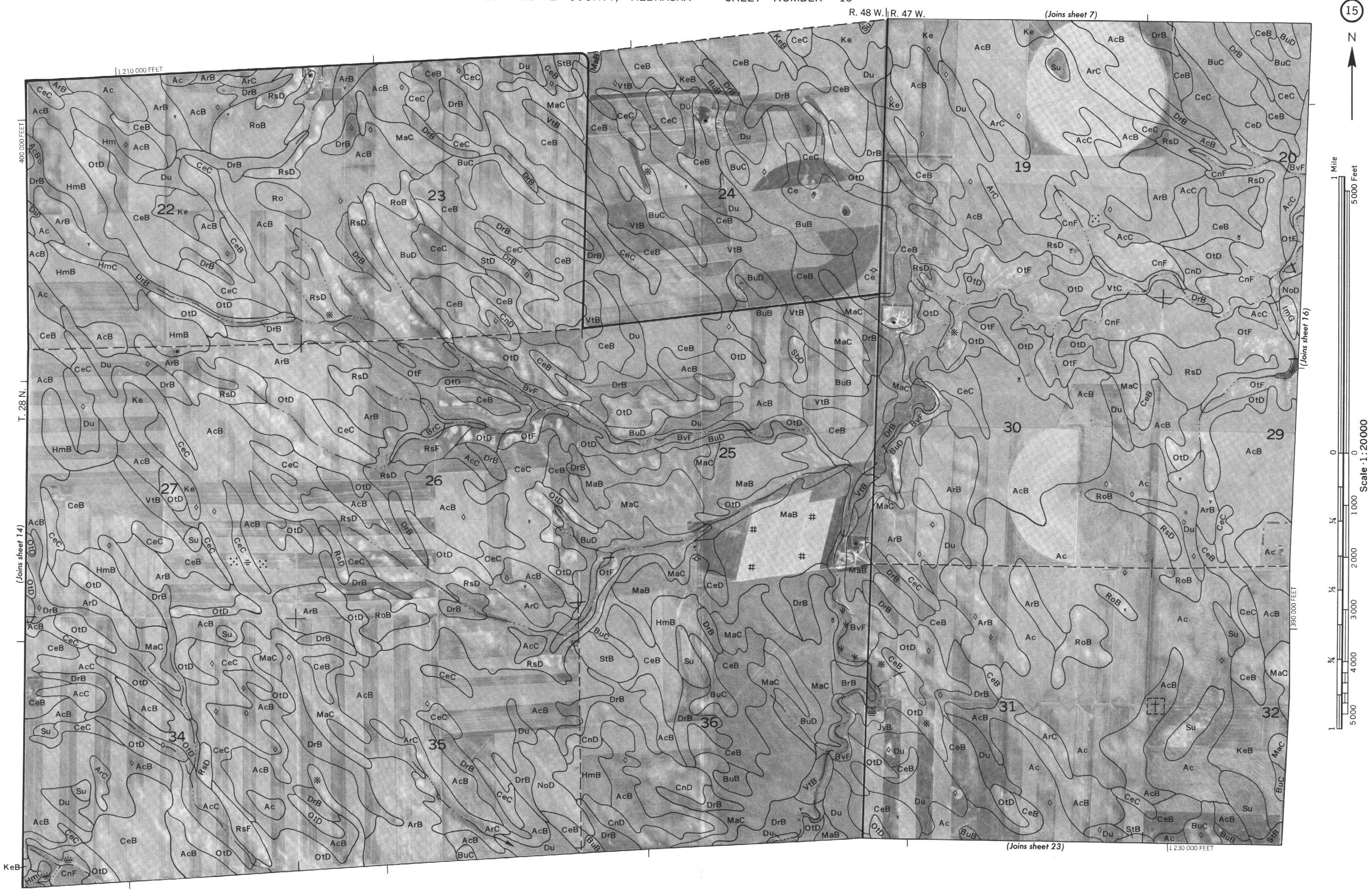
BOX BUTTE COUNTY, NEBRASKA NO. 14



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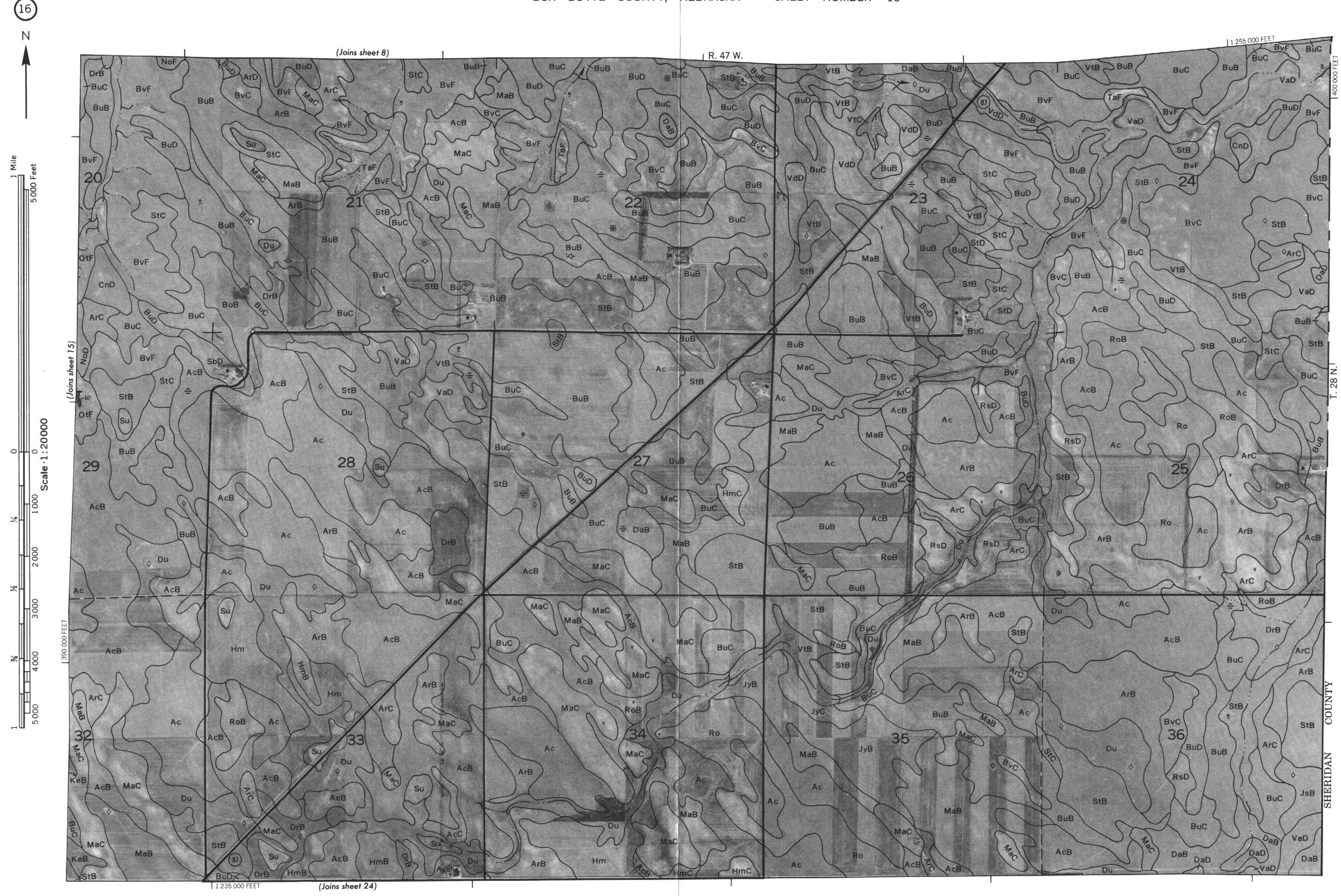

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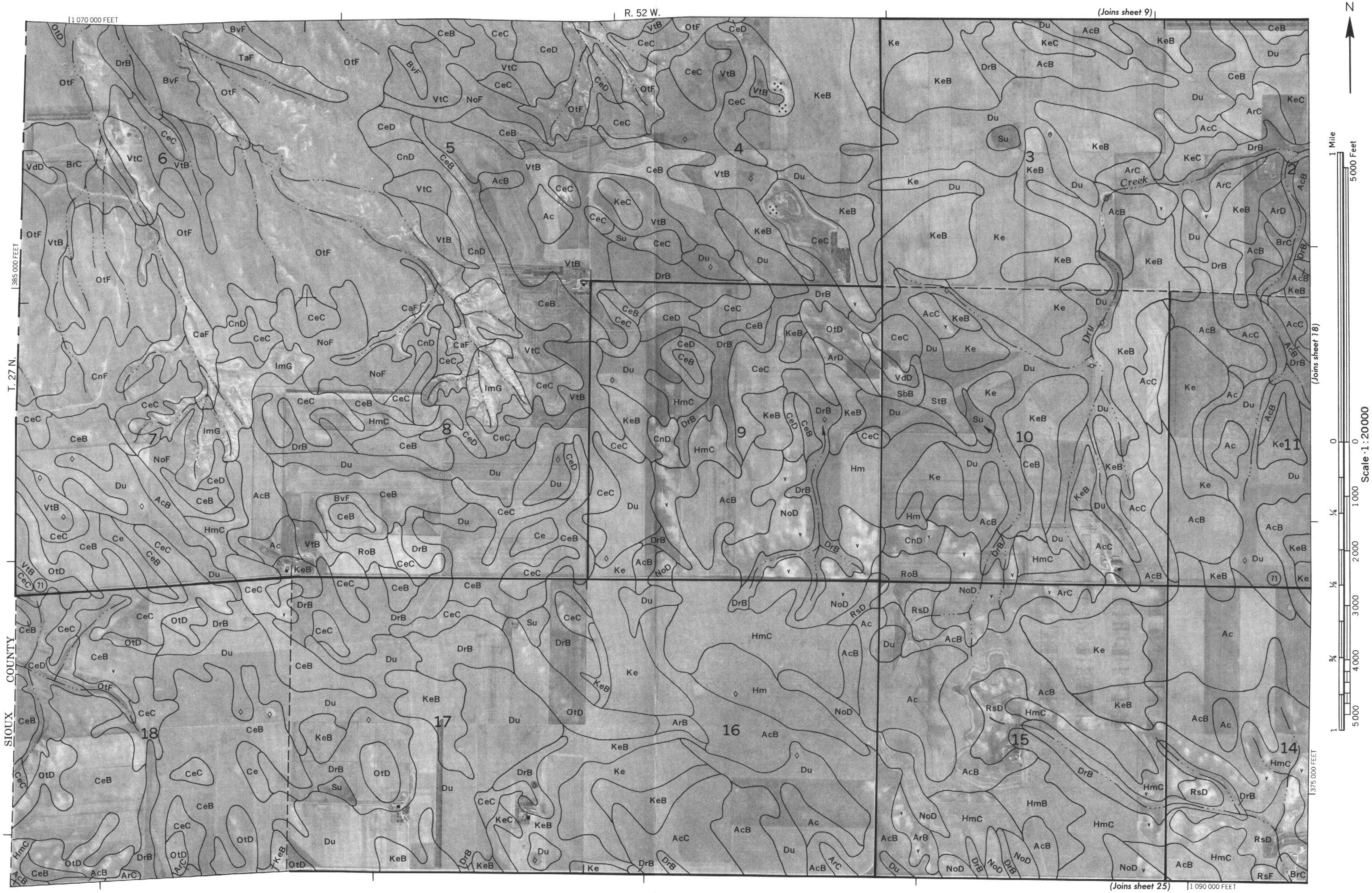

BOX BUTTE COUNTY, NEBRASKA NO. 17

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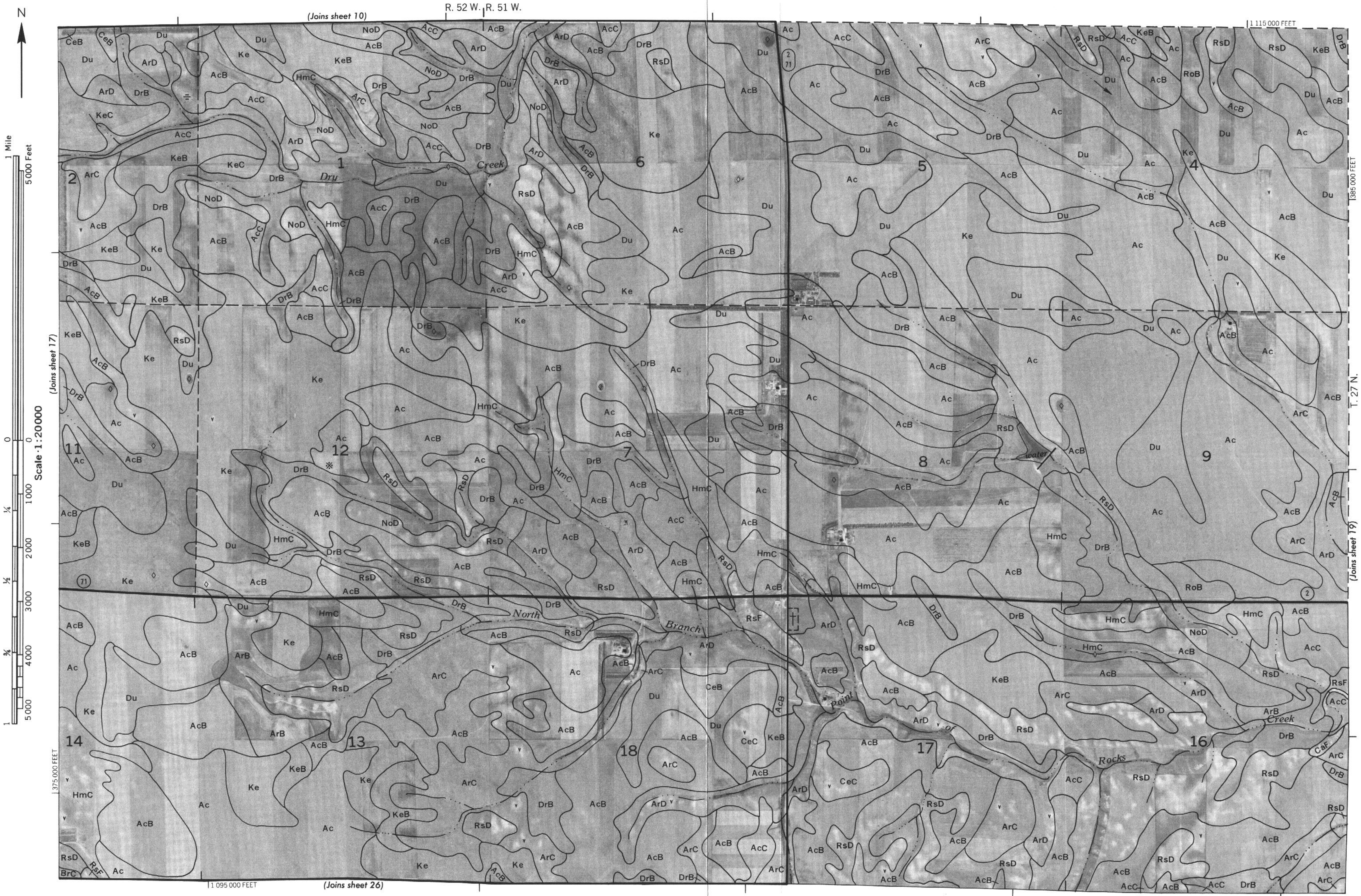

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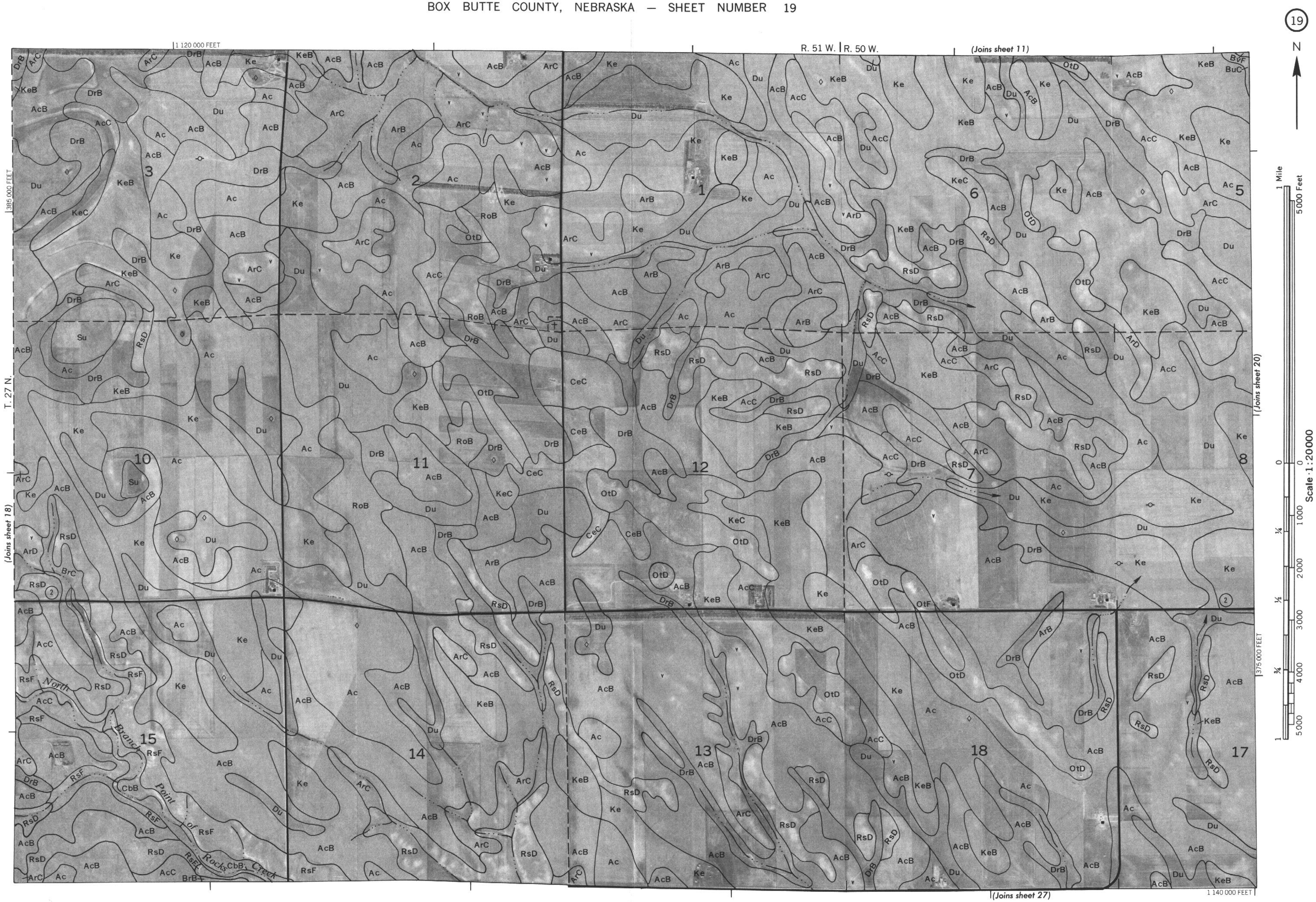

BOX BUTTE COUNTY, NEBRASKA NO. 19

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BOX BUTTE COUNTY, NEBRASKA NO. 21

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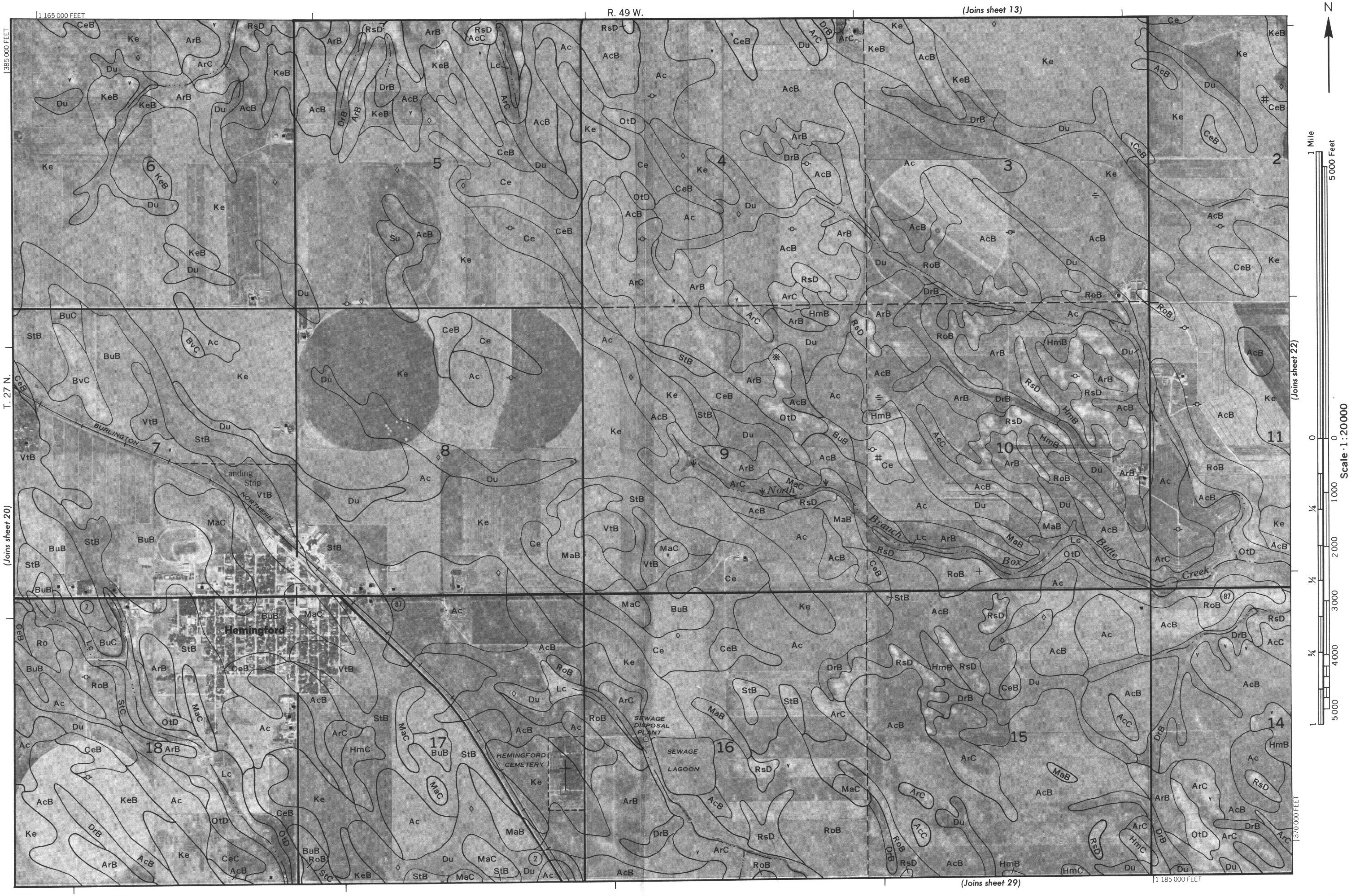

22

N

1 Mile

5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

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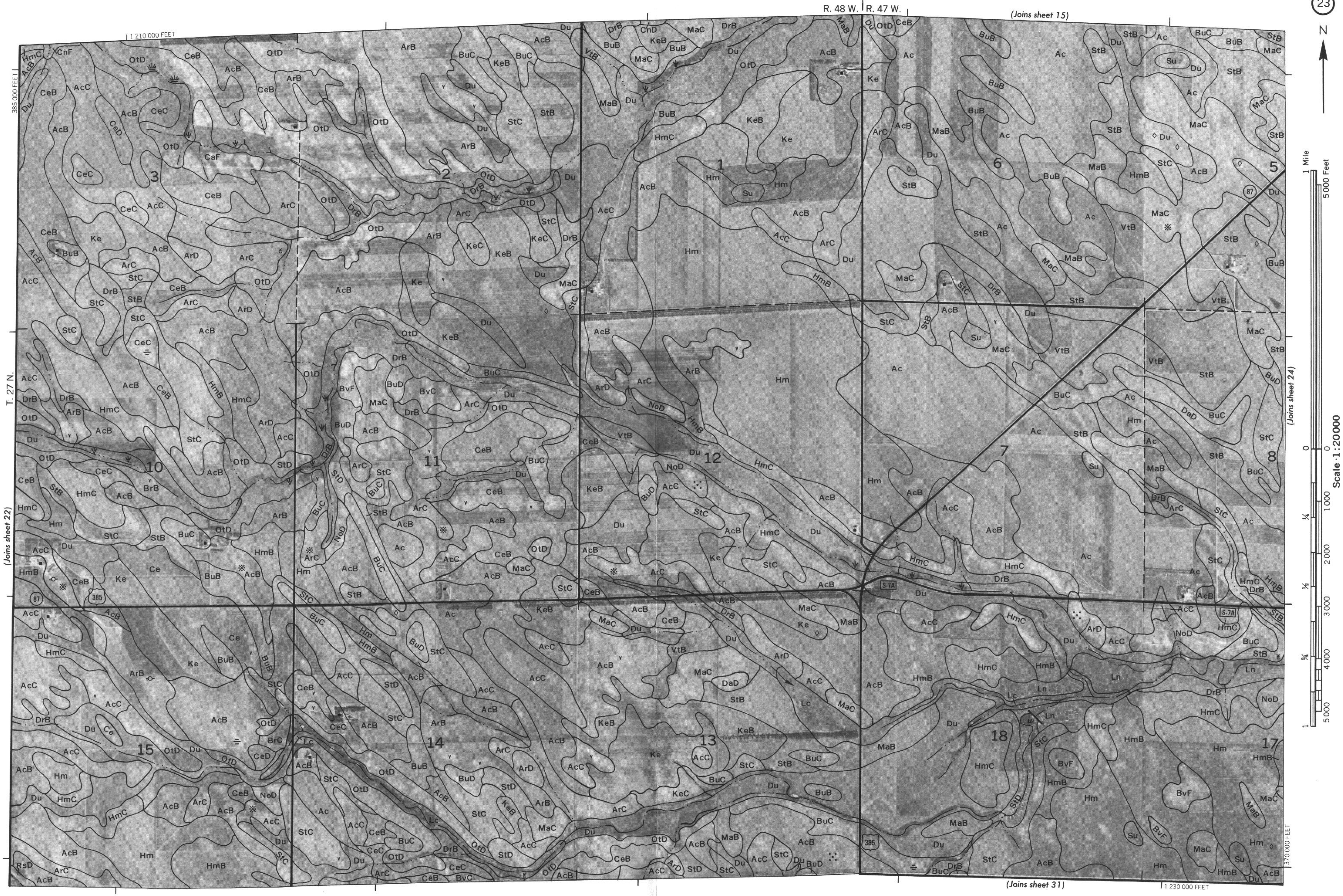
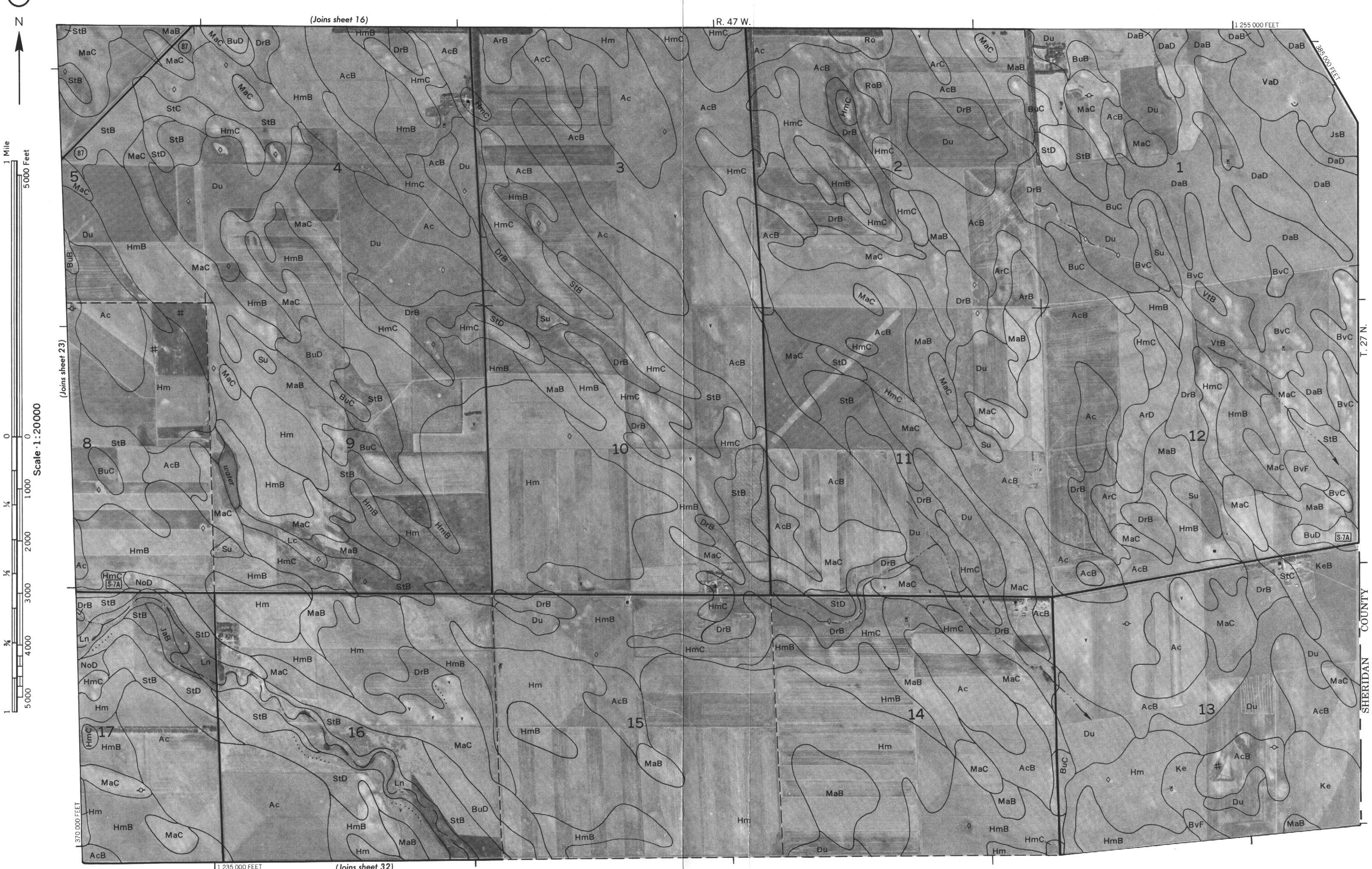
BOX BUTTE COUNTY, NEBRASKA NO. 22

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 23





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BOX BUTTE COUNTY, NEBRASKA NO. 25

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(26)

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
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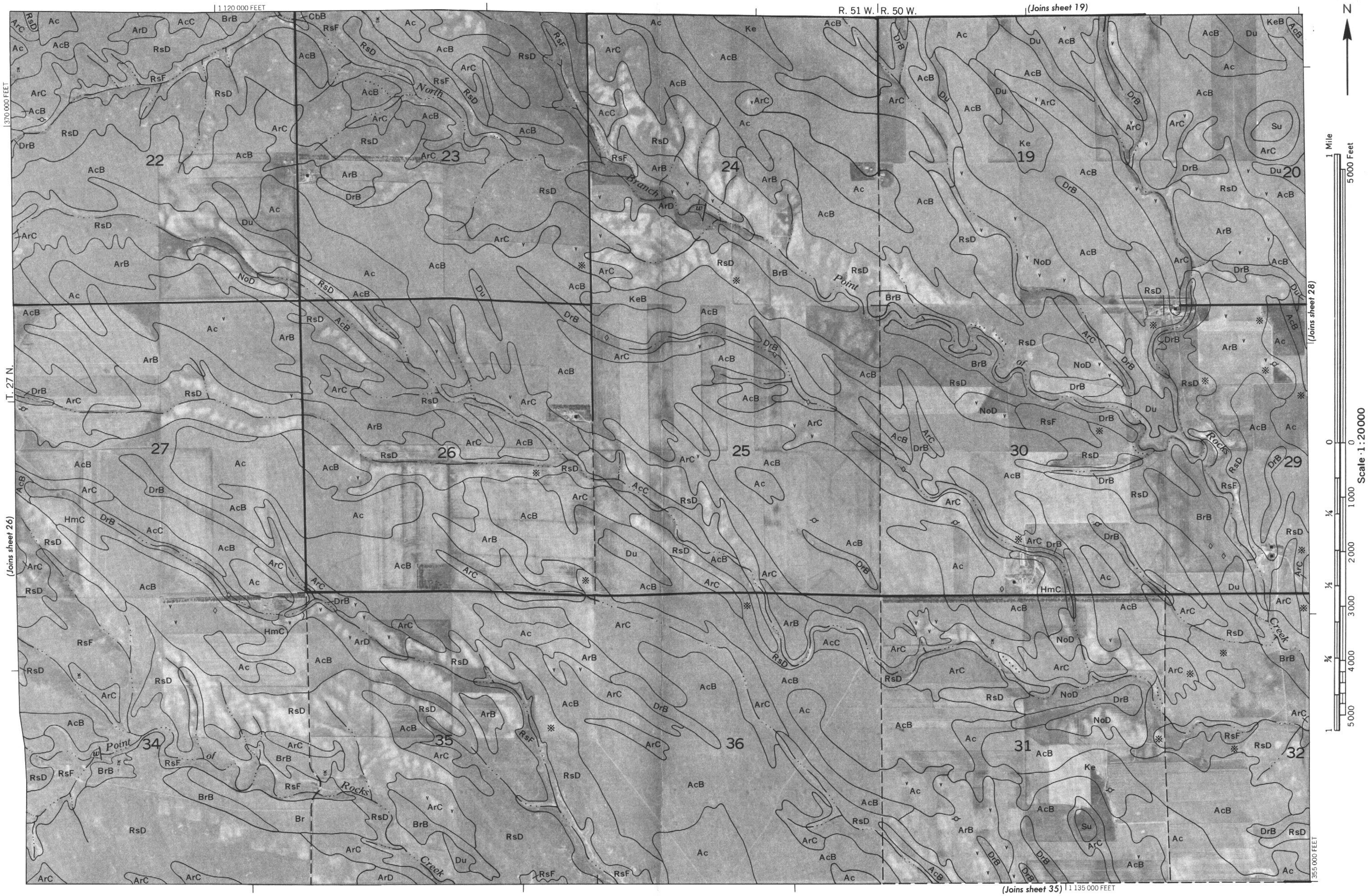

BOX BUTTE COUNTY, NEBRASKA NO. 27

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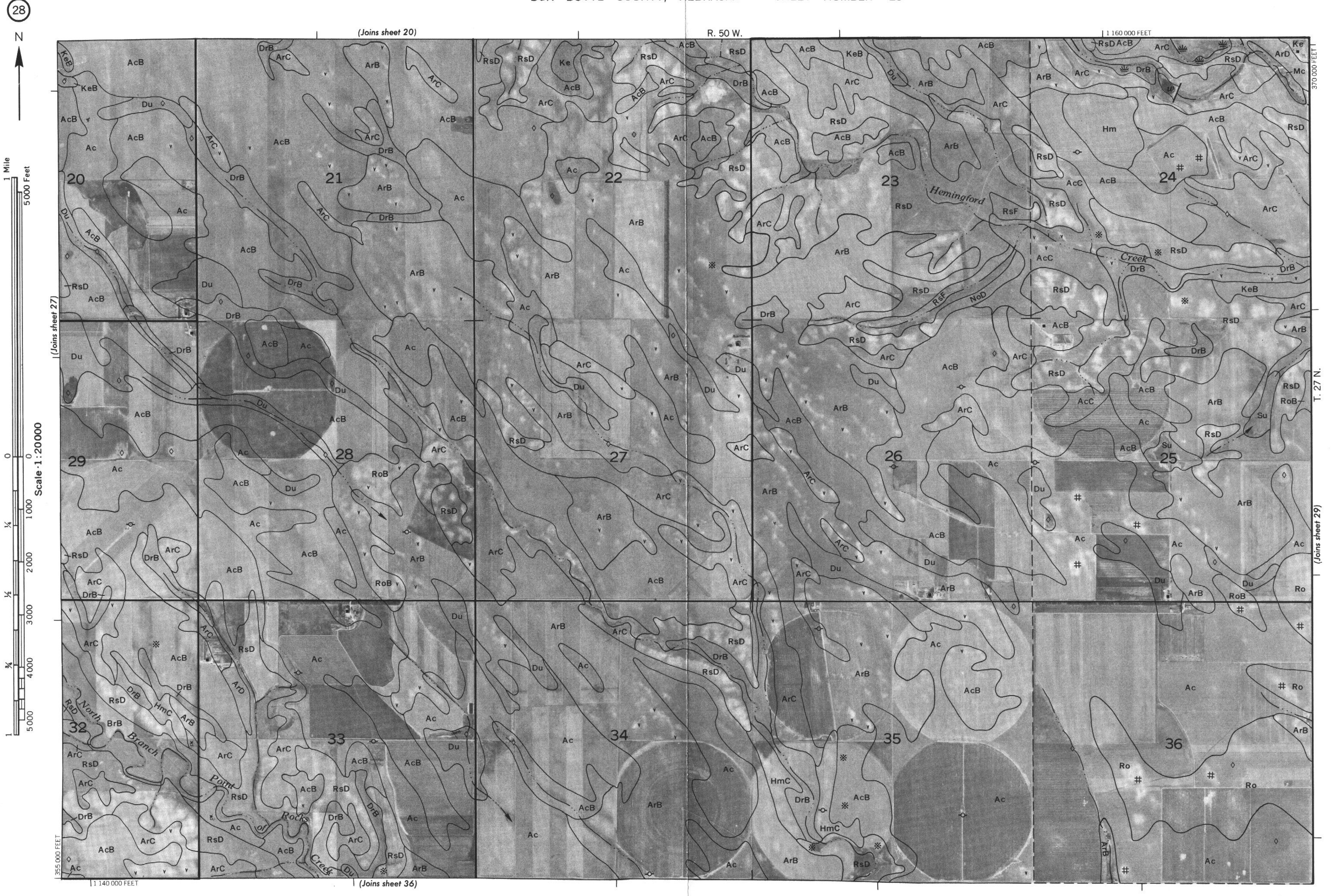

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 28

BOX BUTTE COUNTY, NEBRASKA NO. 29

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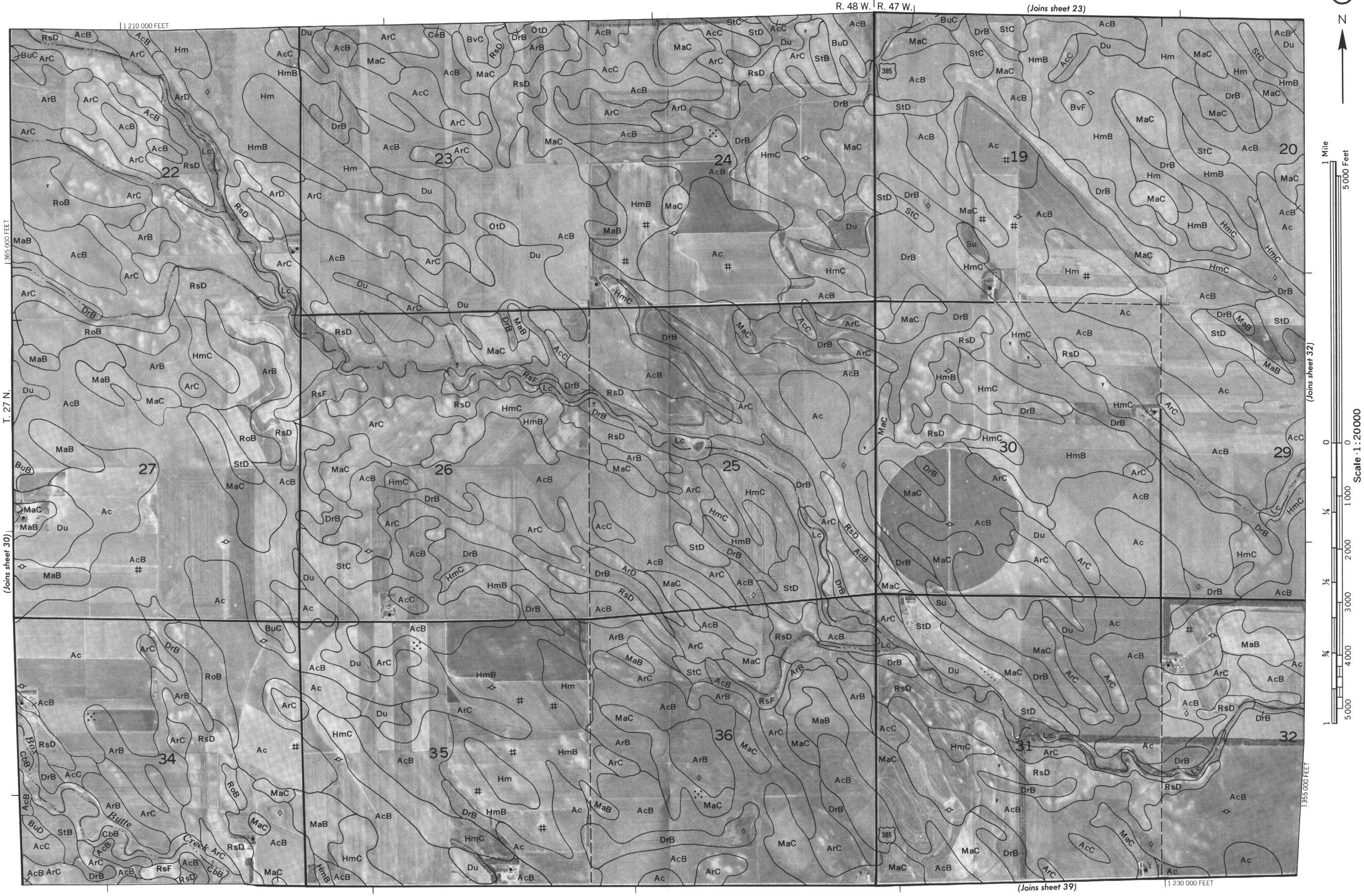

BOX BUTTE COUNTY, NEBRASKA NO. 31

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

33

BOX BUTTE COUNTY, NEBRASKA NO. 33
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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

34

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

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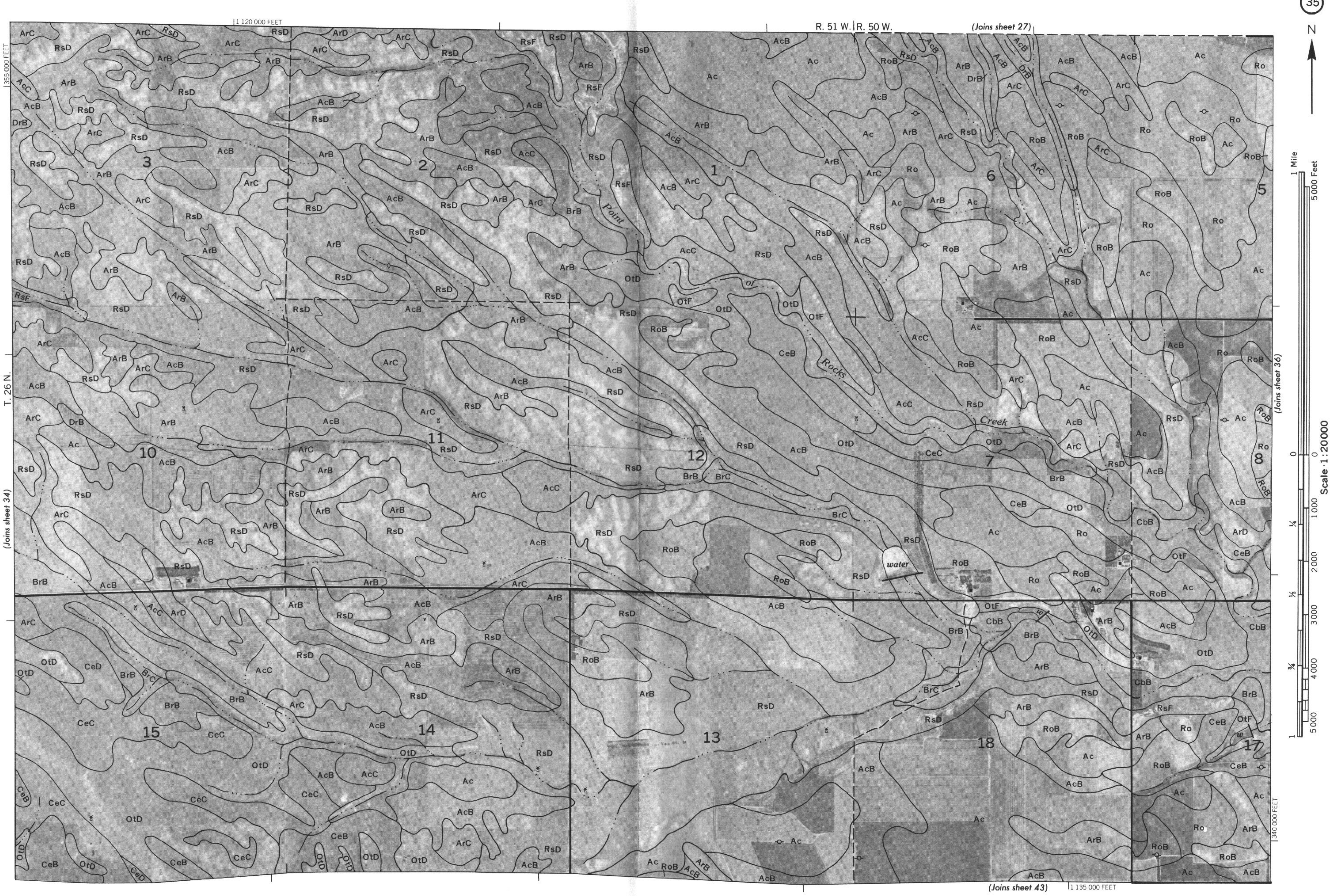
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



BOX BUTTE COUNTY, NEBRASKA NO. 35

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 36

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 36

37

BOX BUTTE COUNTY, NEBRASKA NO. 37

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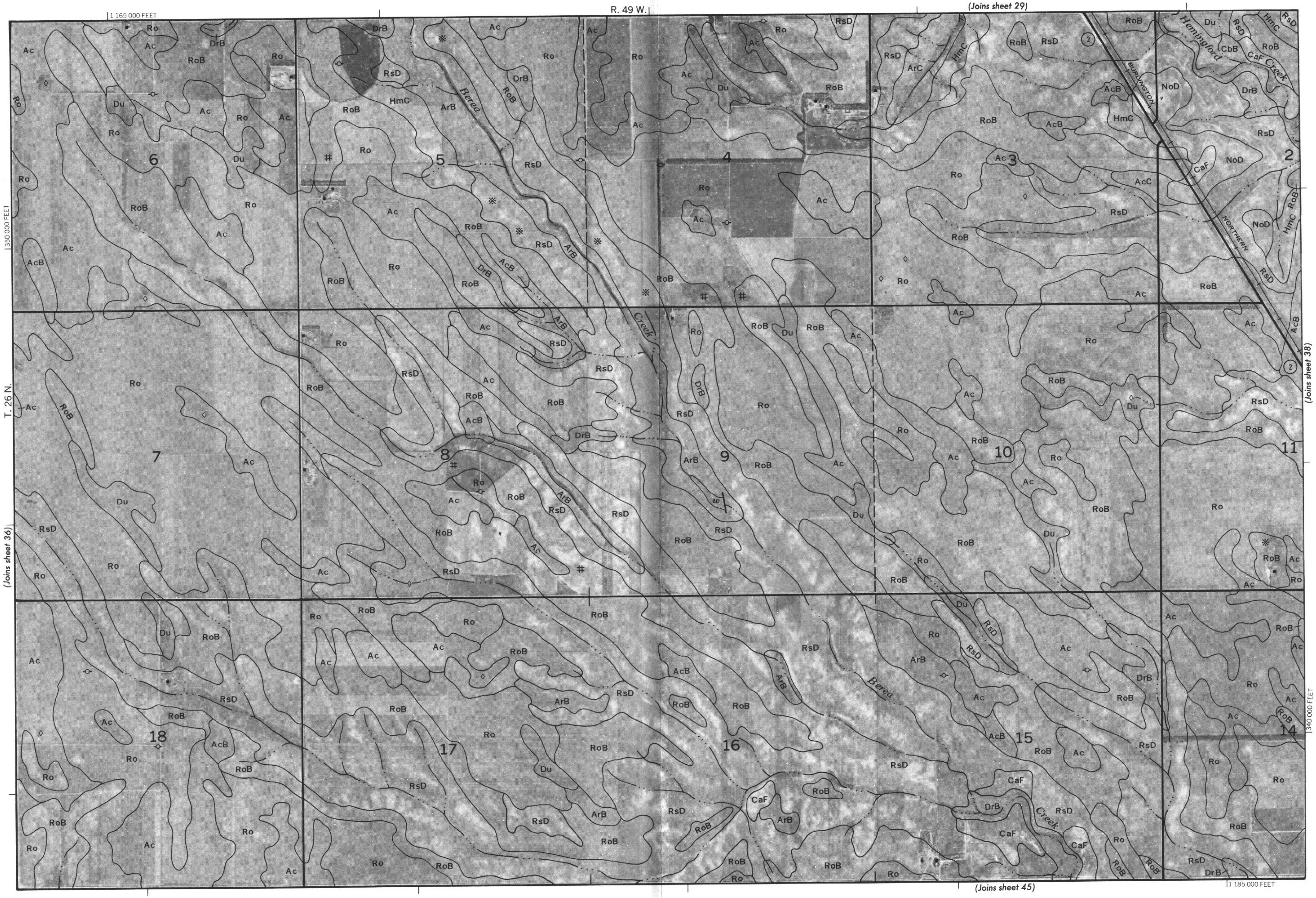

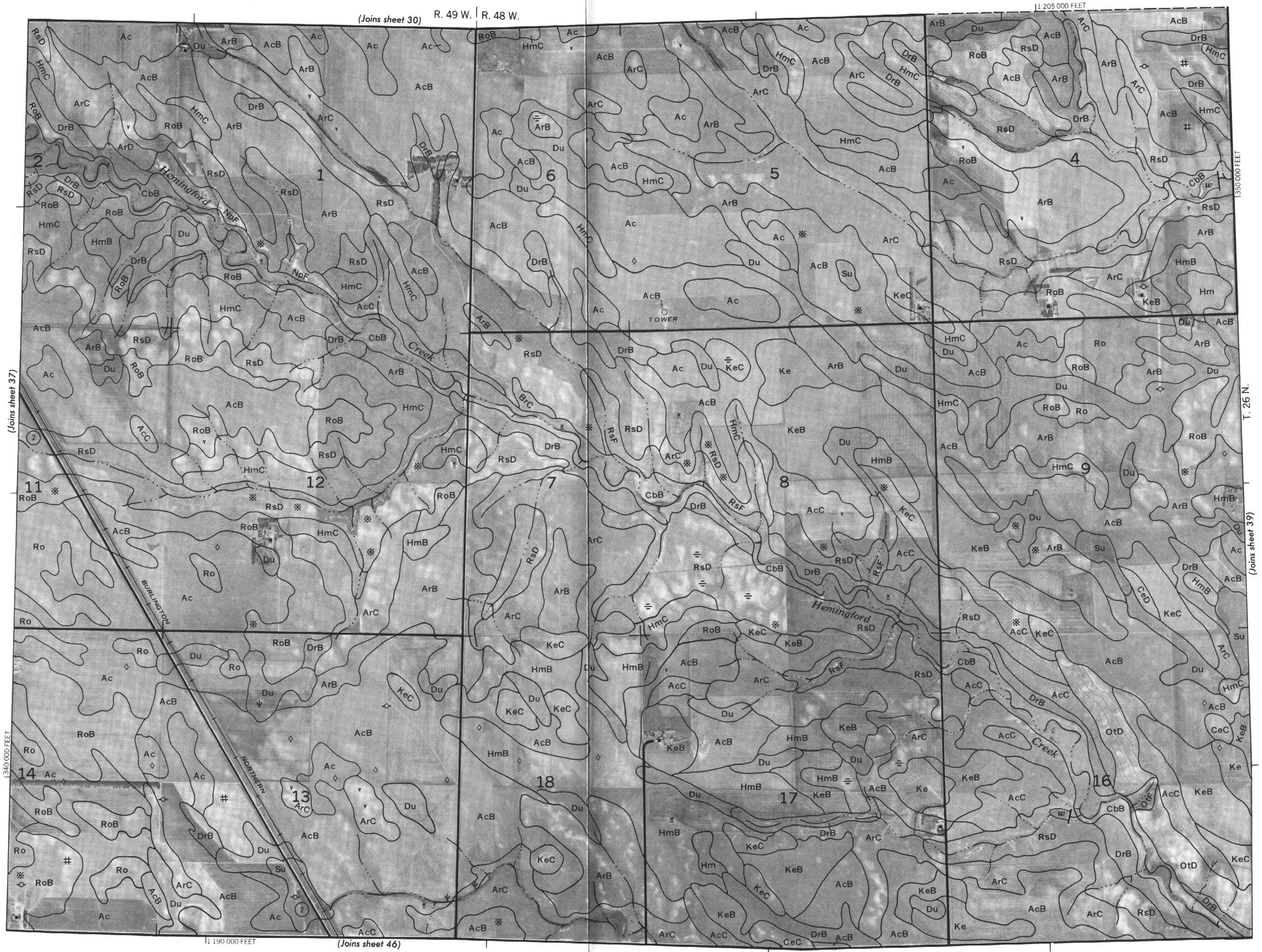

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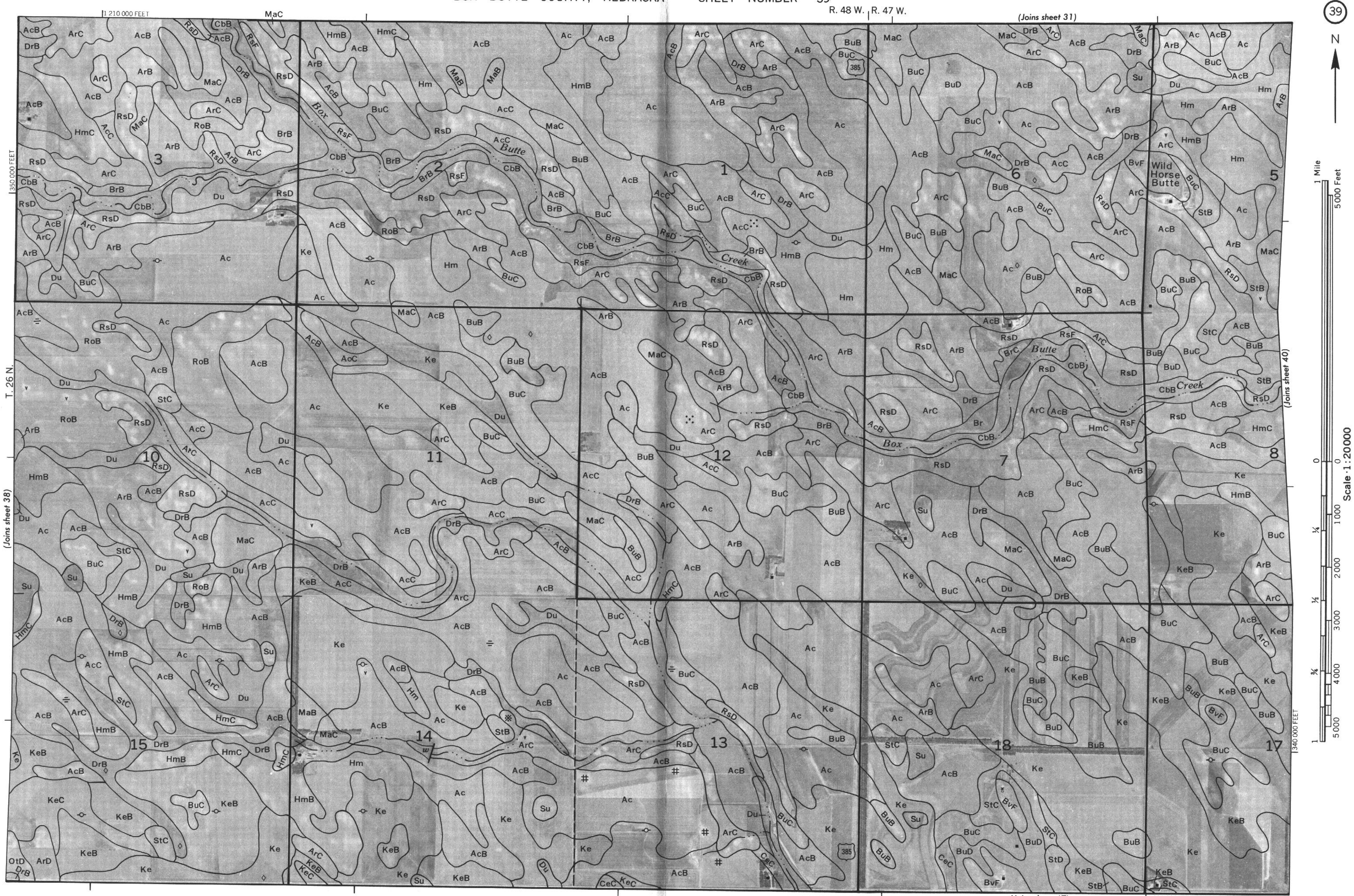

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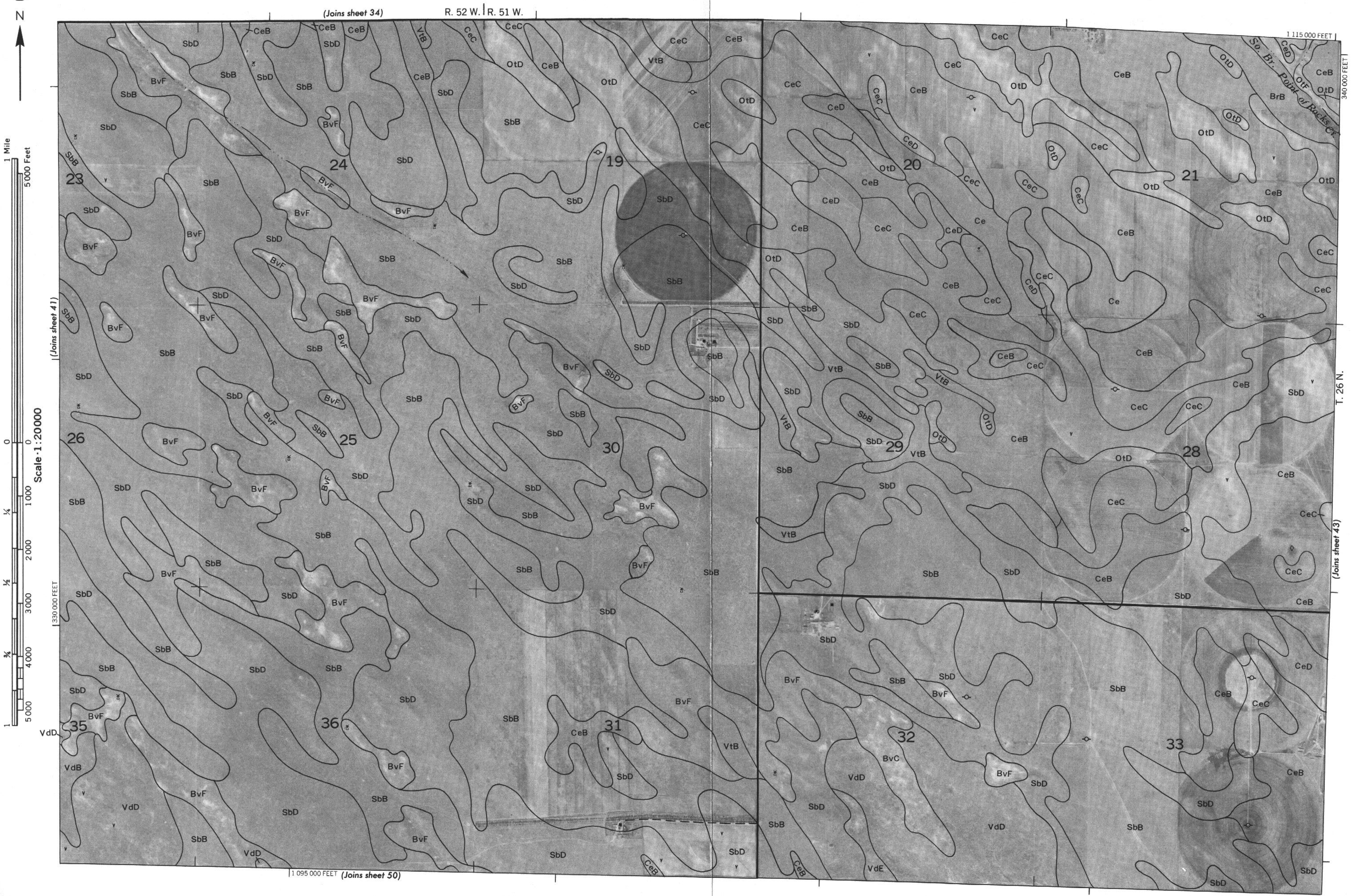
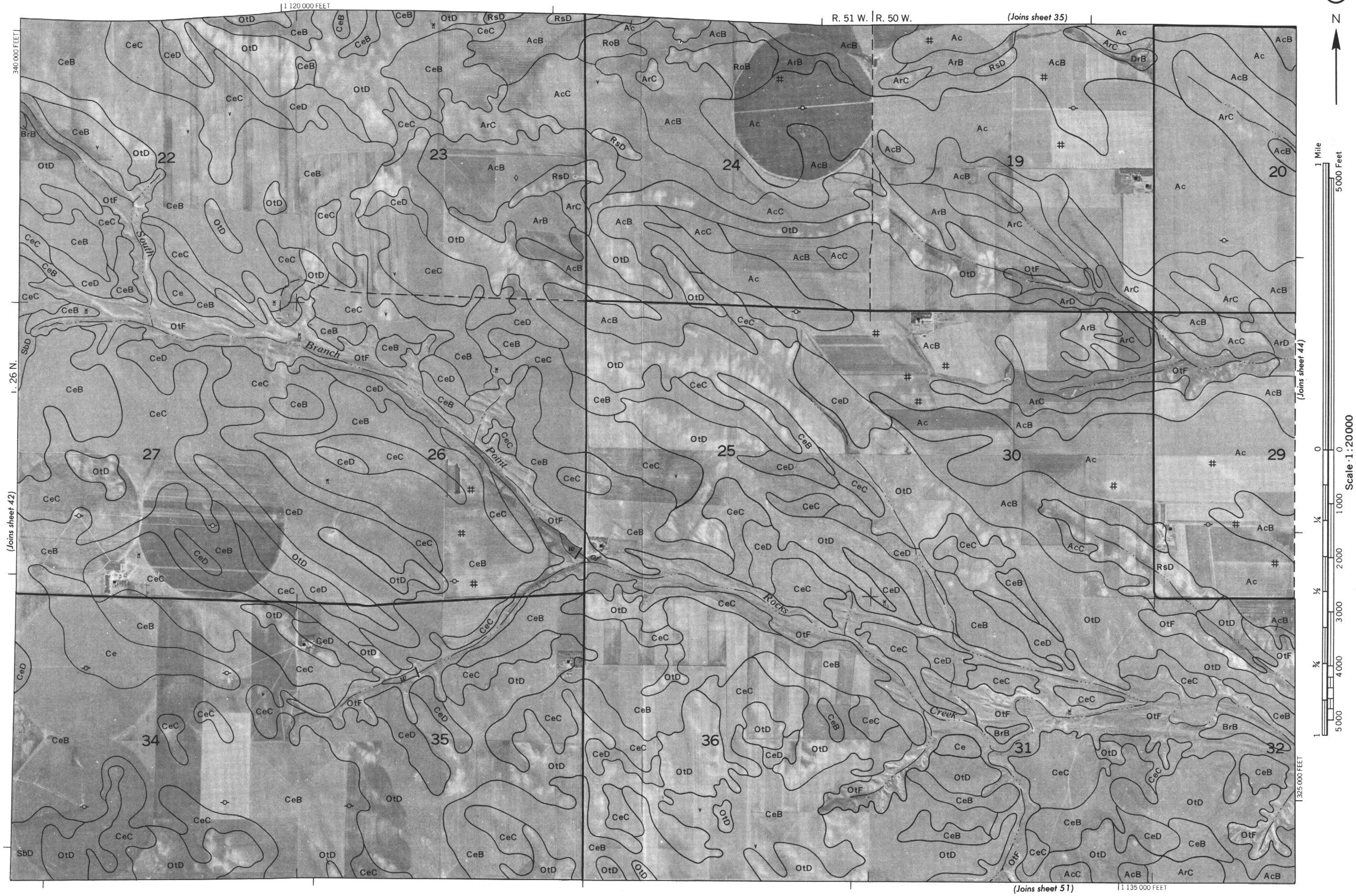
BOX BUTTE COUNTY, NEBRASKA NO. 41

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



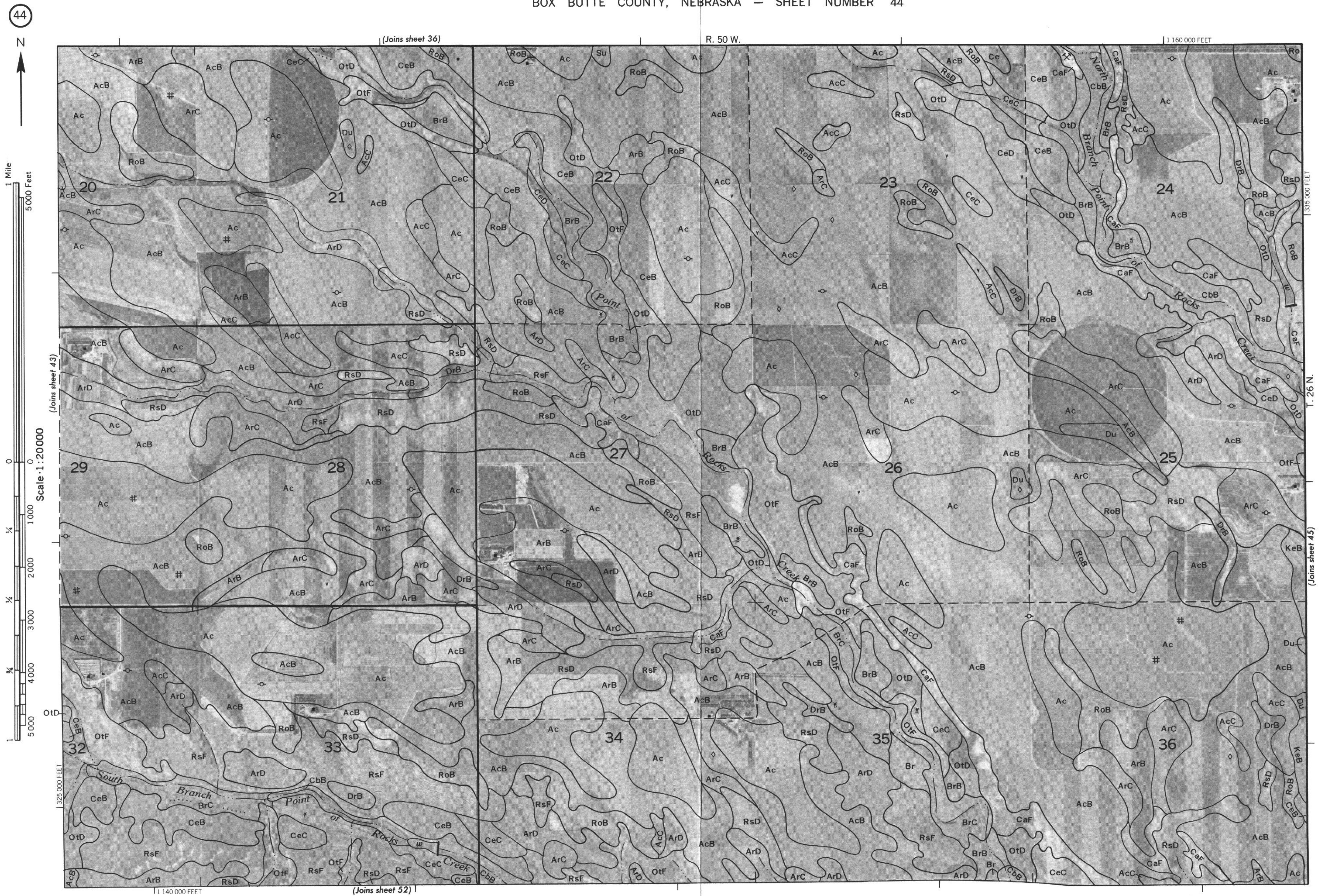
This map is compiled on 1974 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

43



BOX BUTTE COUNTY, NEBRASKA NO. 43

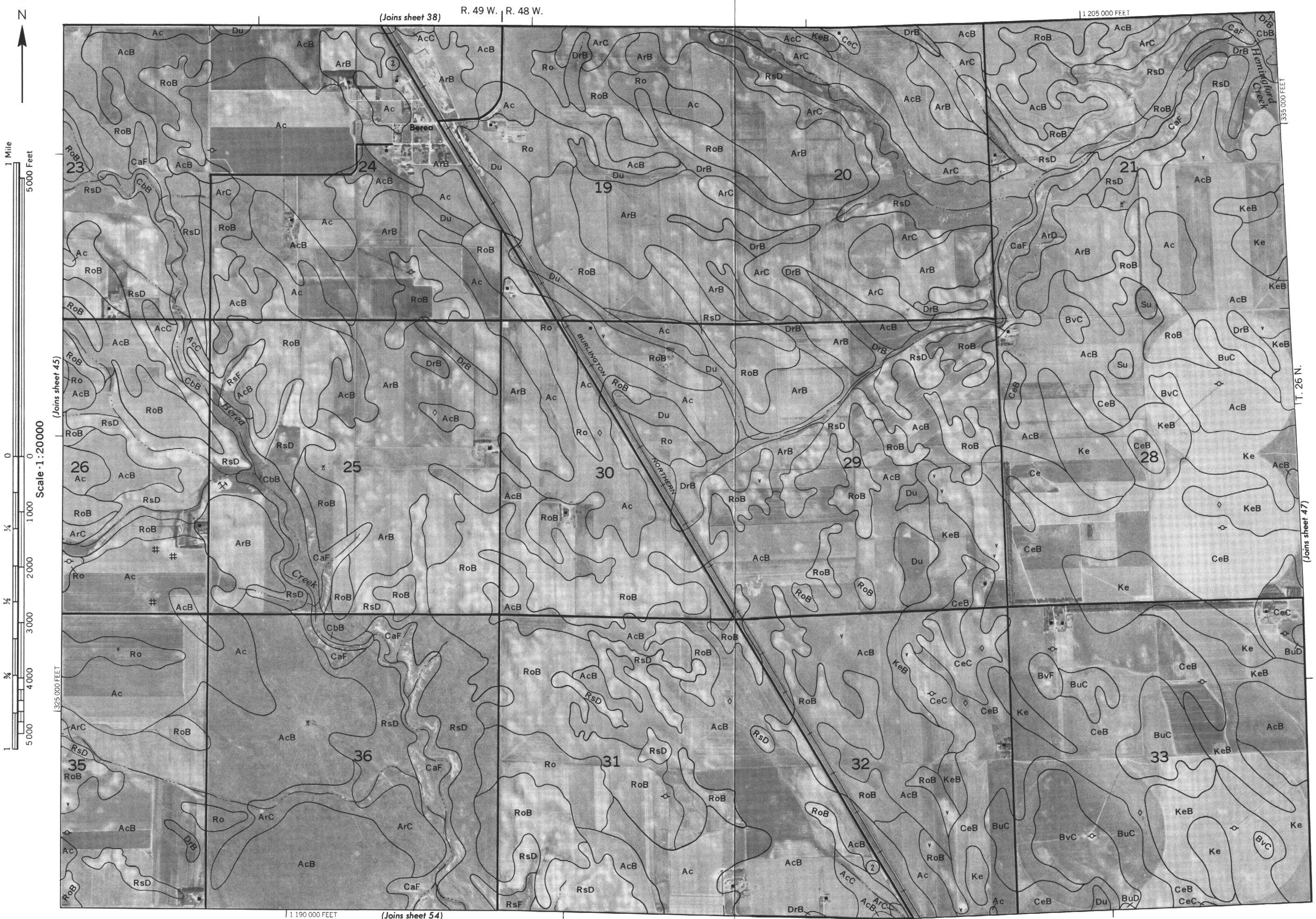
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



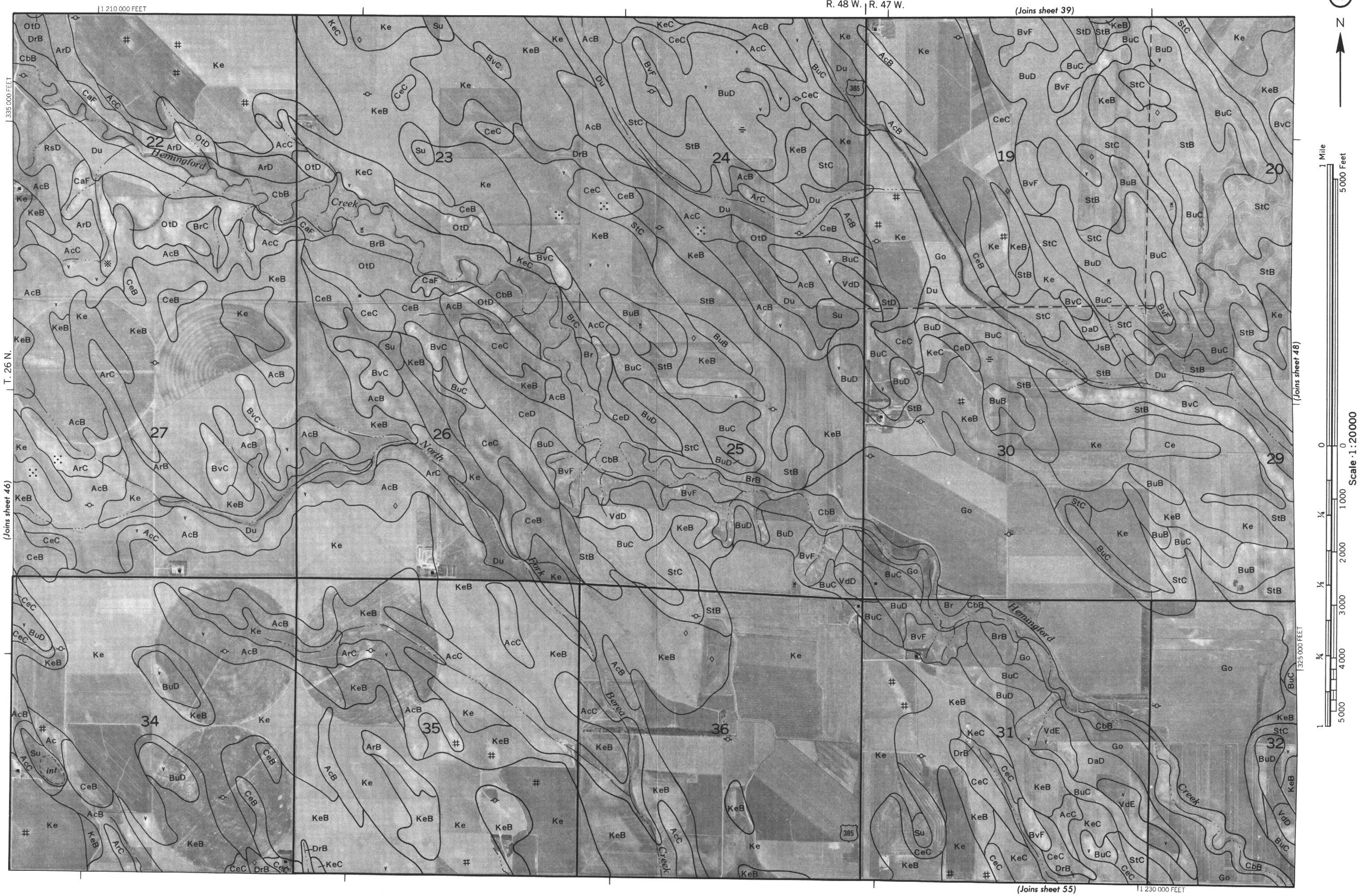
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 45

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



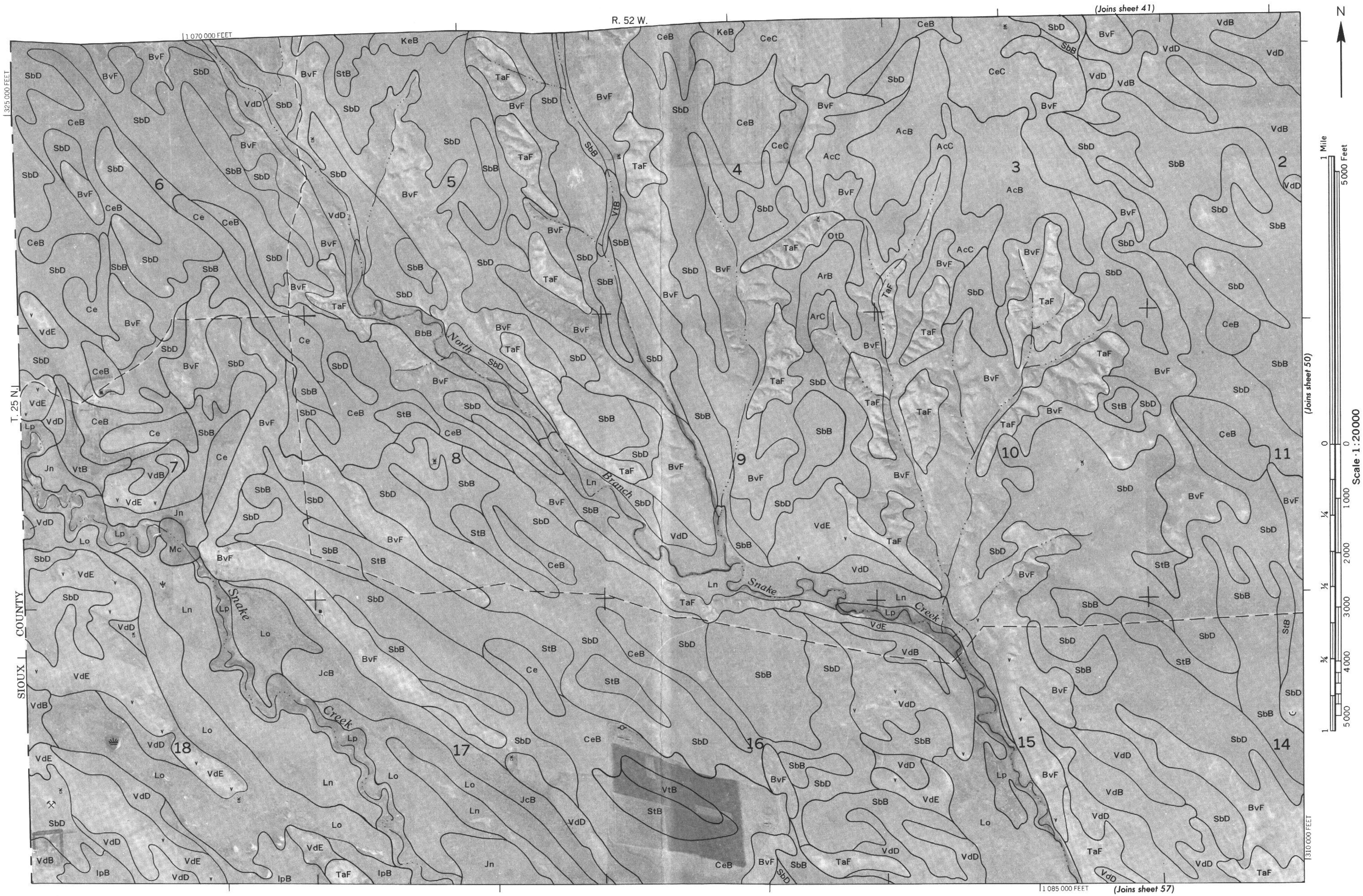
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

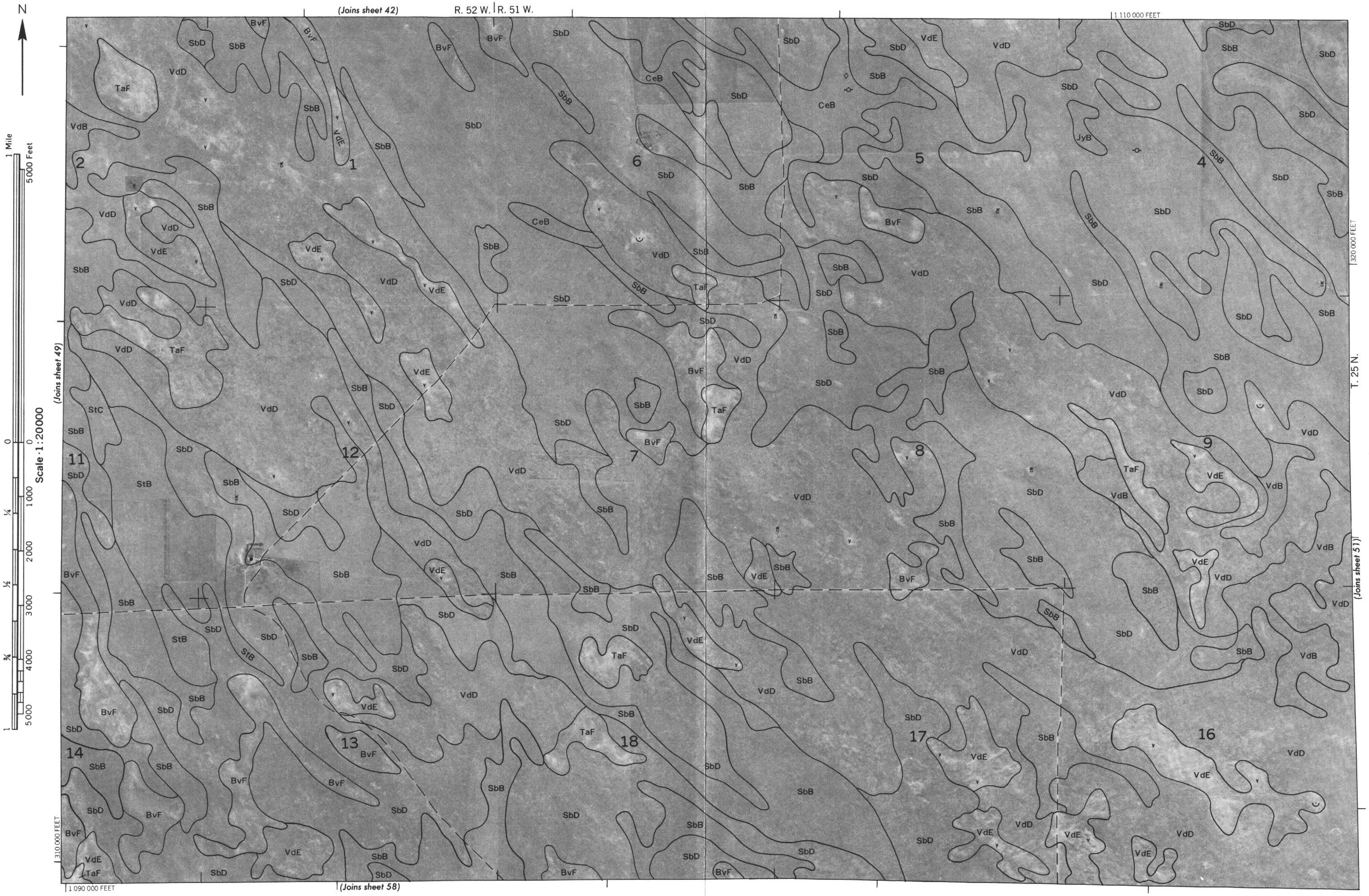
(49)



BOX BUTTE COUNTY, NEBRASKA NO. 49

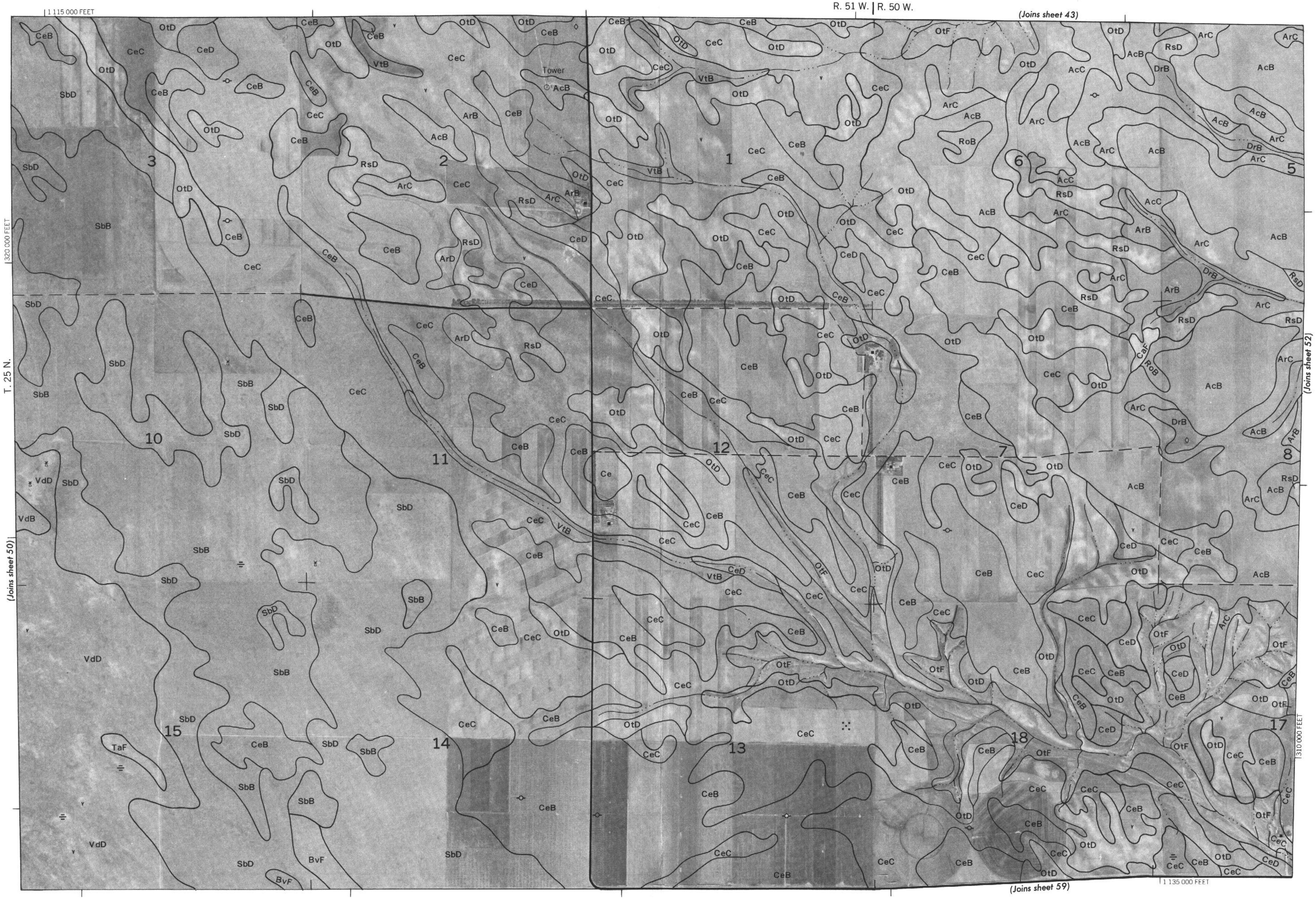
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 50



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

51



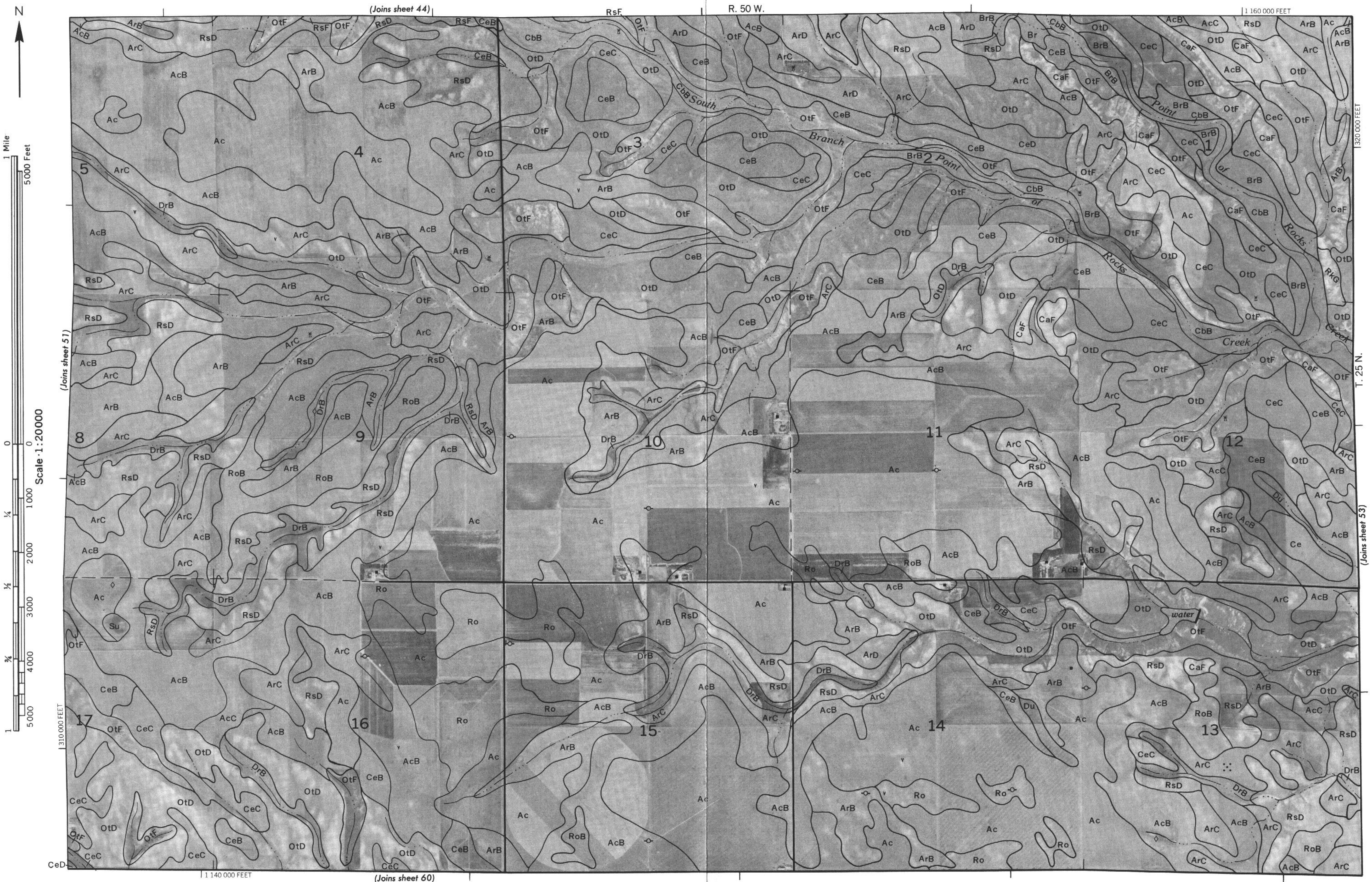
N

1 Mile
5000 Feet
Scale 1:20000

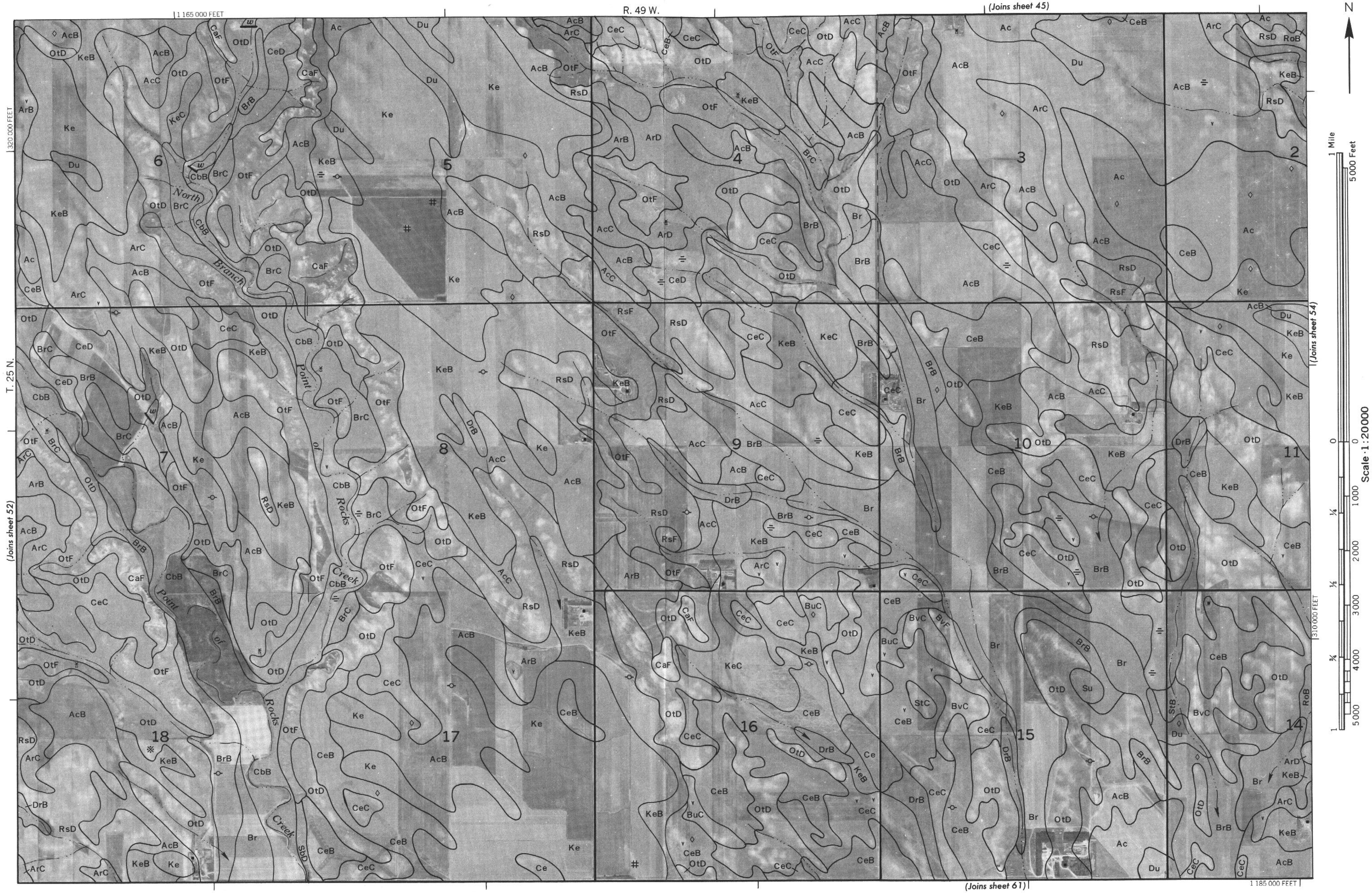
BOX BUTTE COUNTY, NEBRASKA NO. 51

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

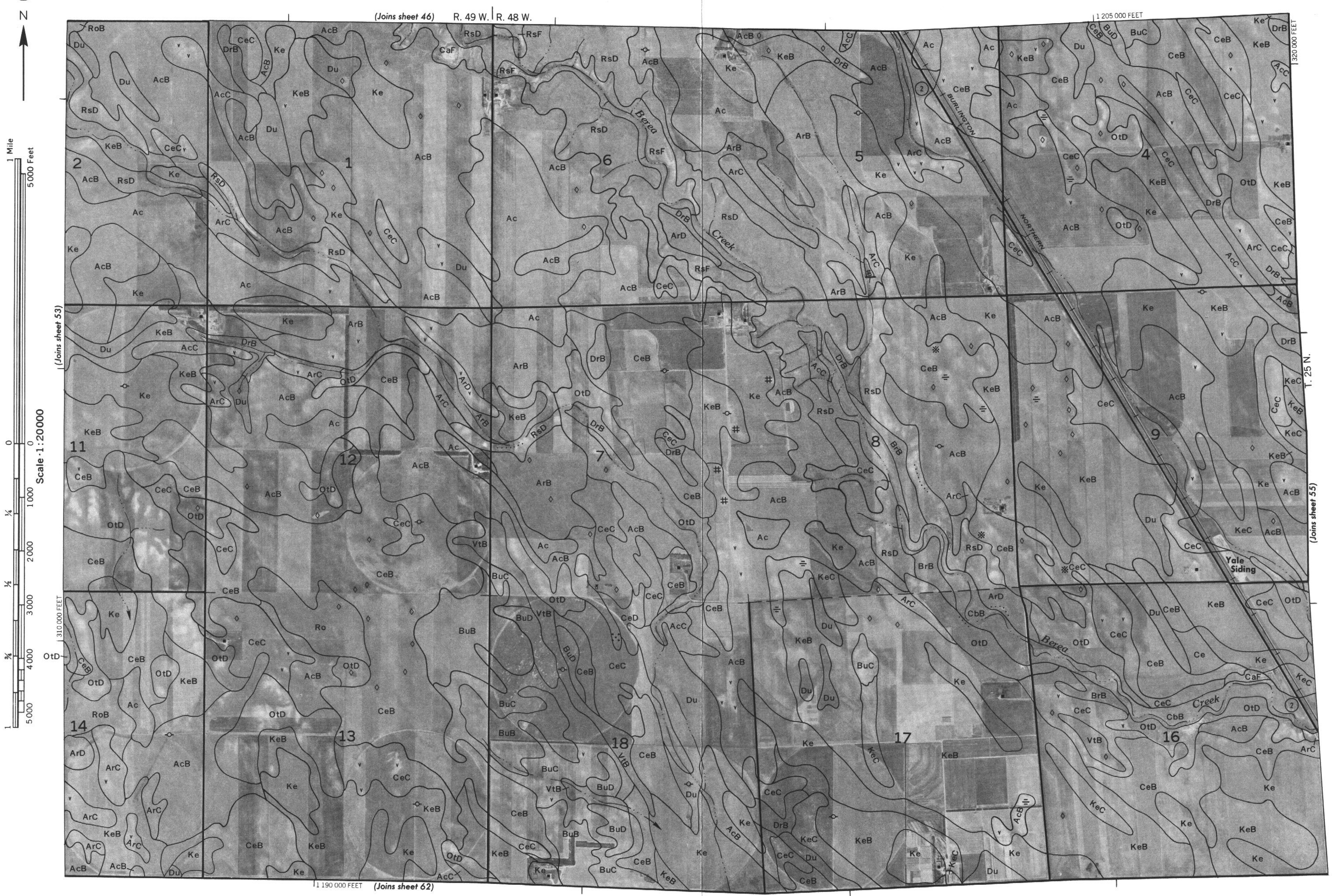
BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 52



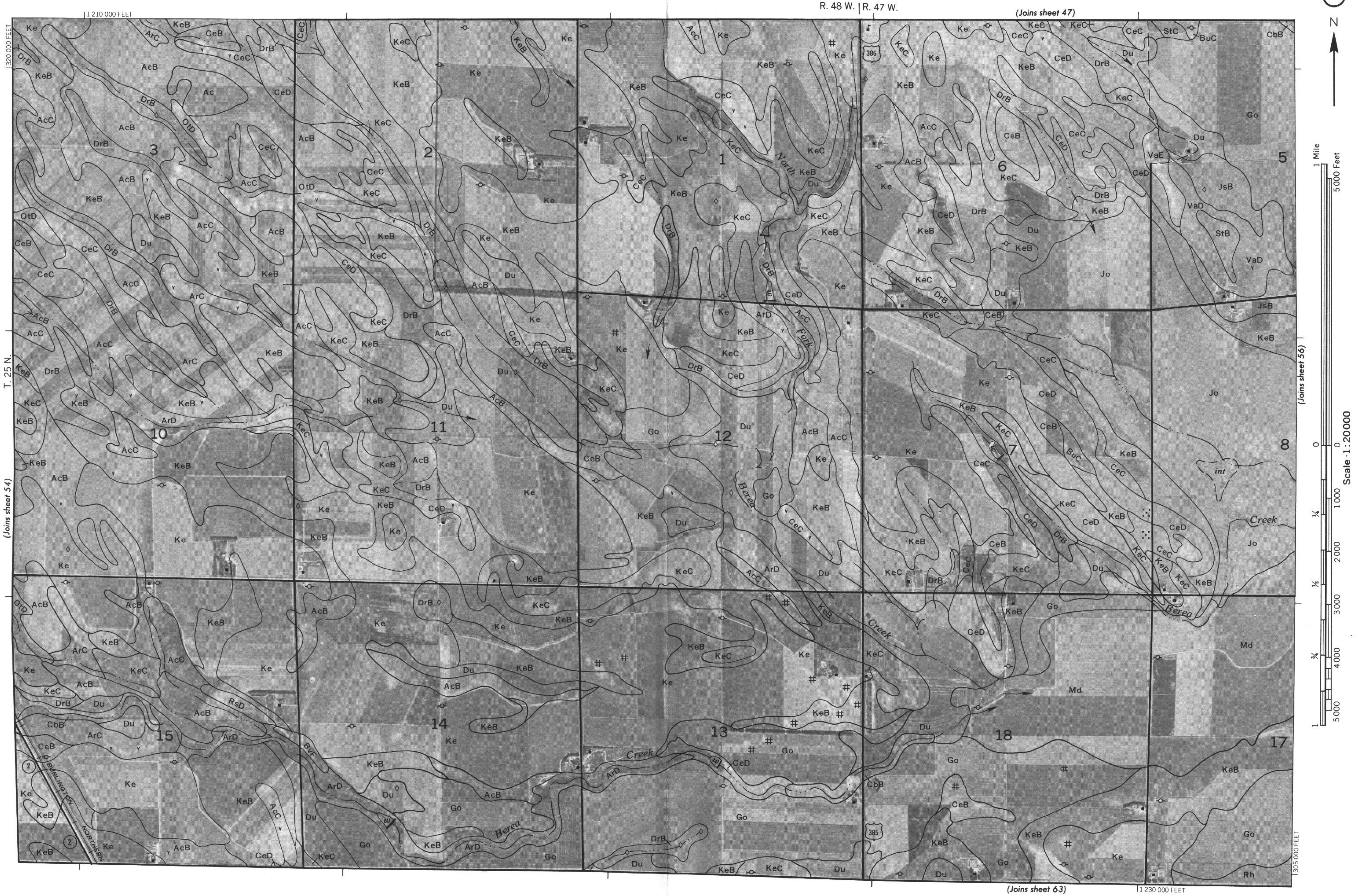
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



BOX BUTTE COUNTY, NEBRASKA NO. 53
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

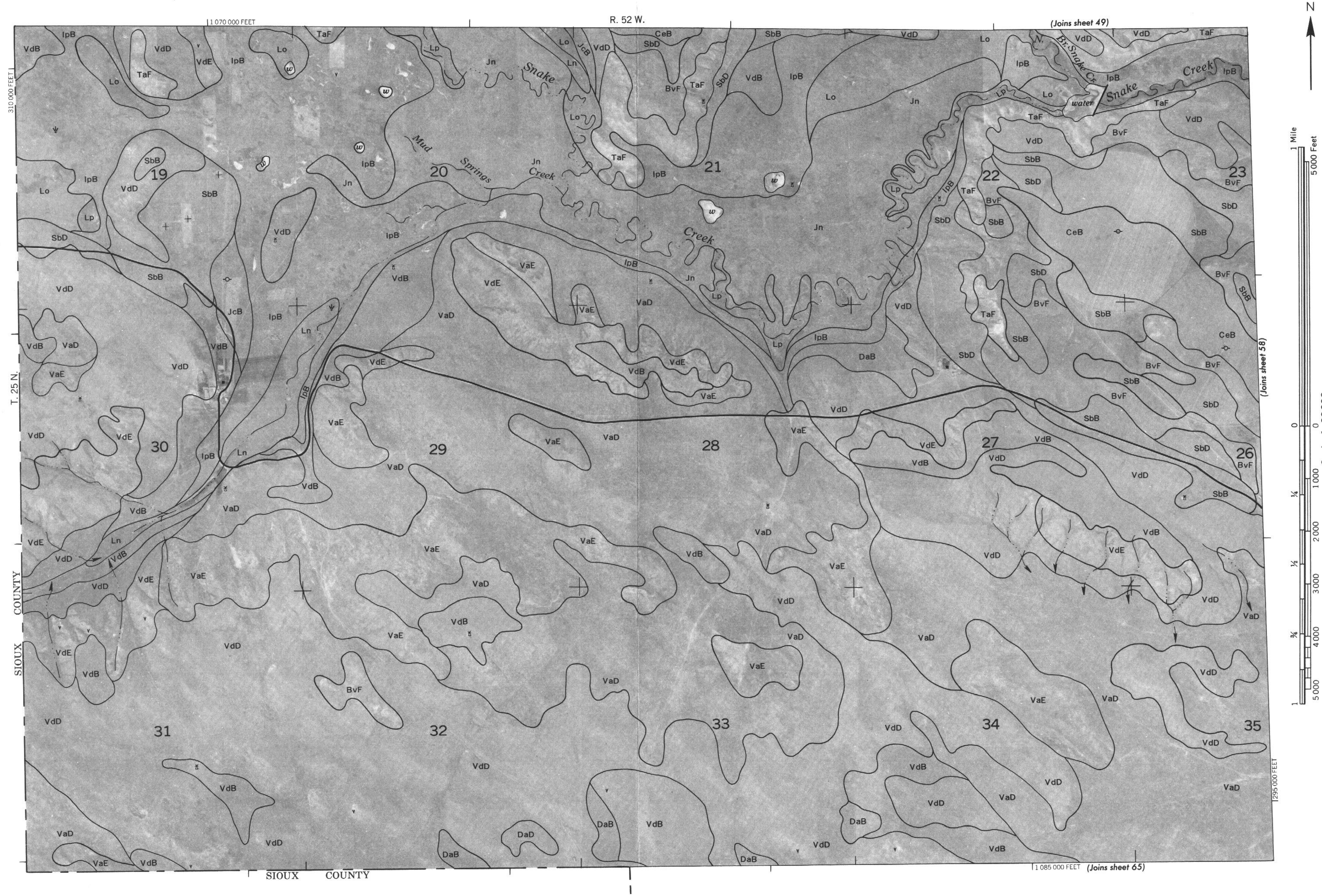


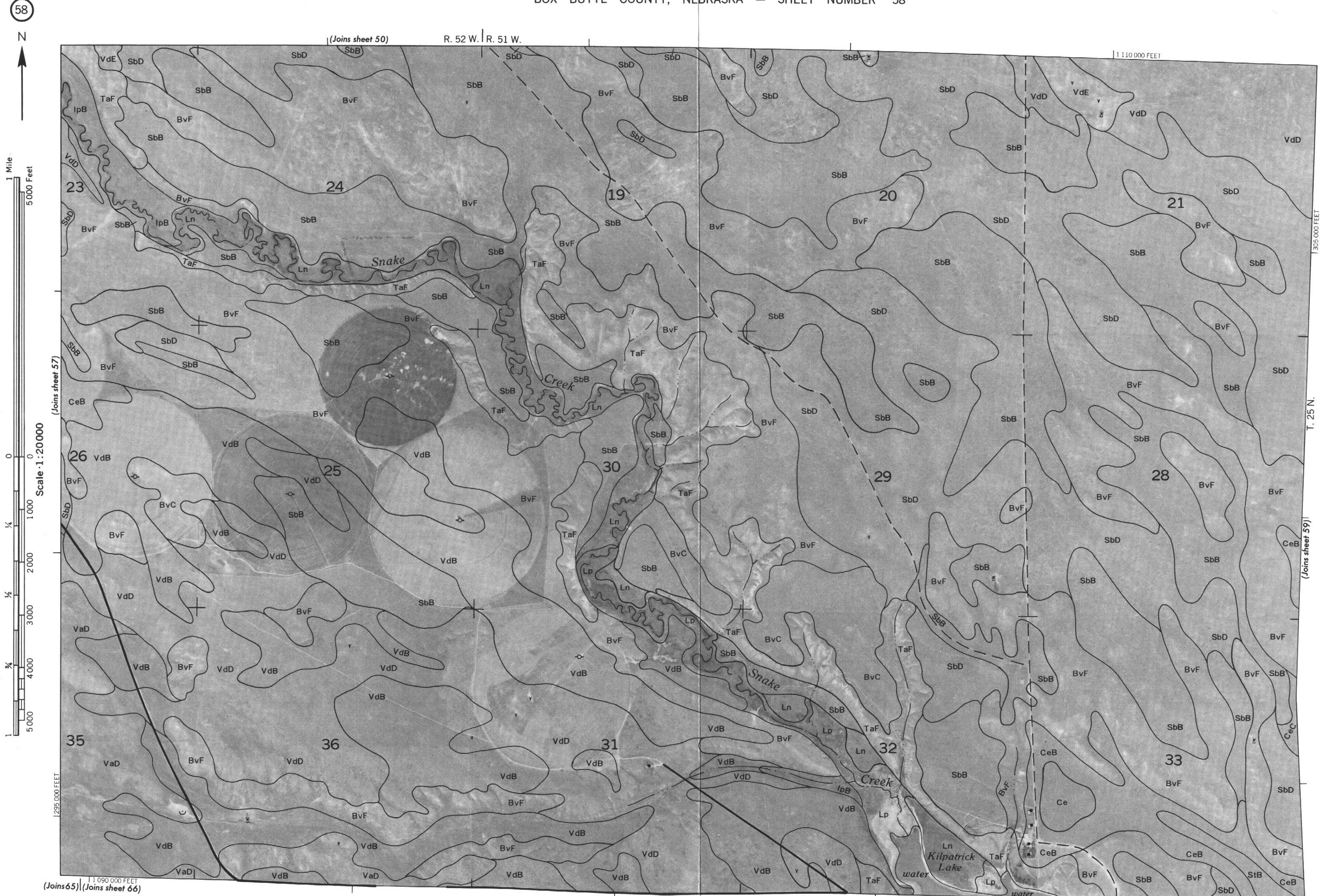
BOX BUTTE COUNTY, NEBRASKA NO. 55

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

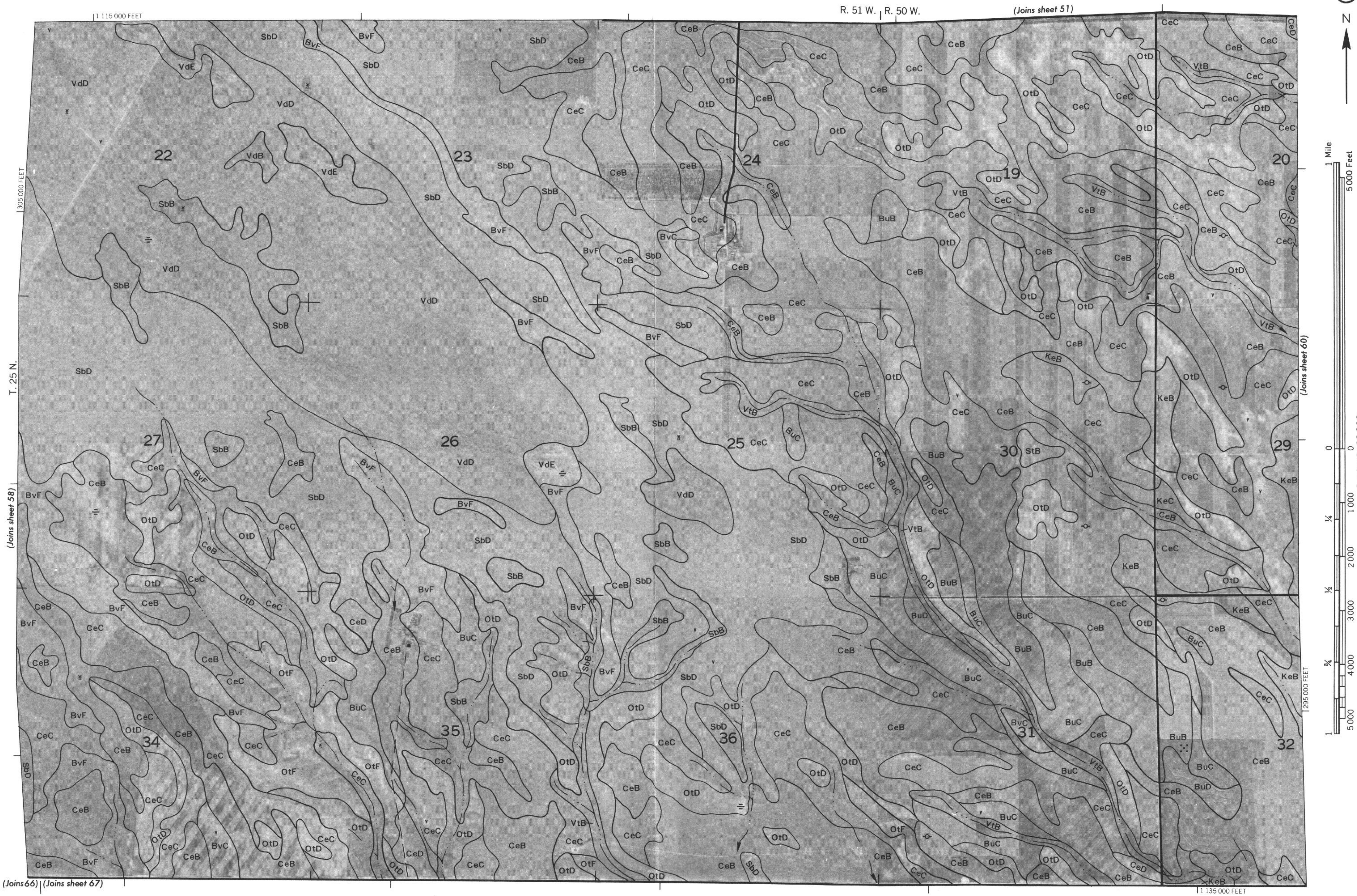
BOX BUTTE COUNTY, NEBRASKA NO. 56


57
N
R. 52 W.
1 070 000 FEET
310 000 FEET
T. 25 N.
(Joins sheet 49)
(Joins sheet 58)
(Joins sheet 65)
1 085 000 FEET
295 000 FEET
SIOUX COUNTY
SIOUX COUNTY
Snake Creek
N. Br. Snake Cr.
Mud Springs Creek
water
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1 Mile
5000 Feet
Scale 1:20000
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



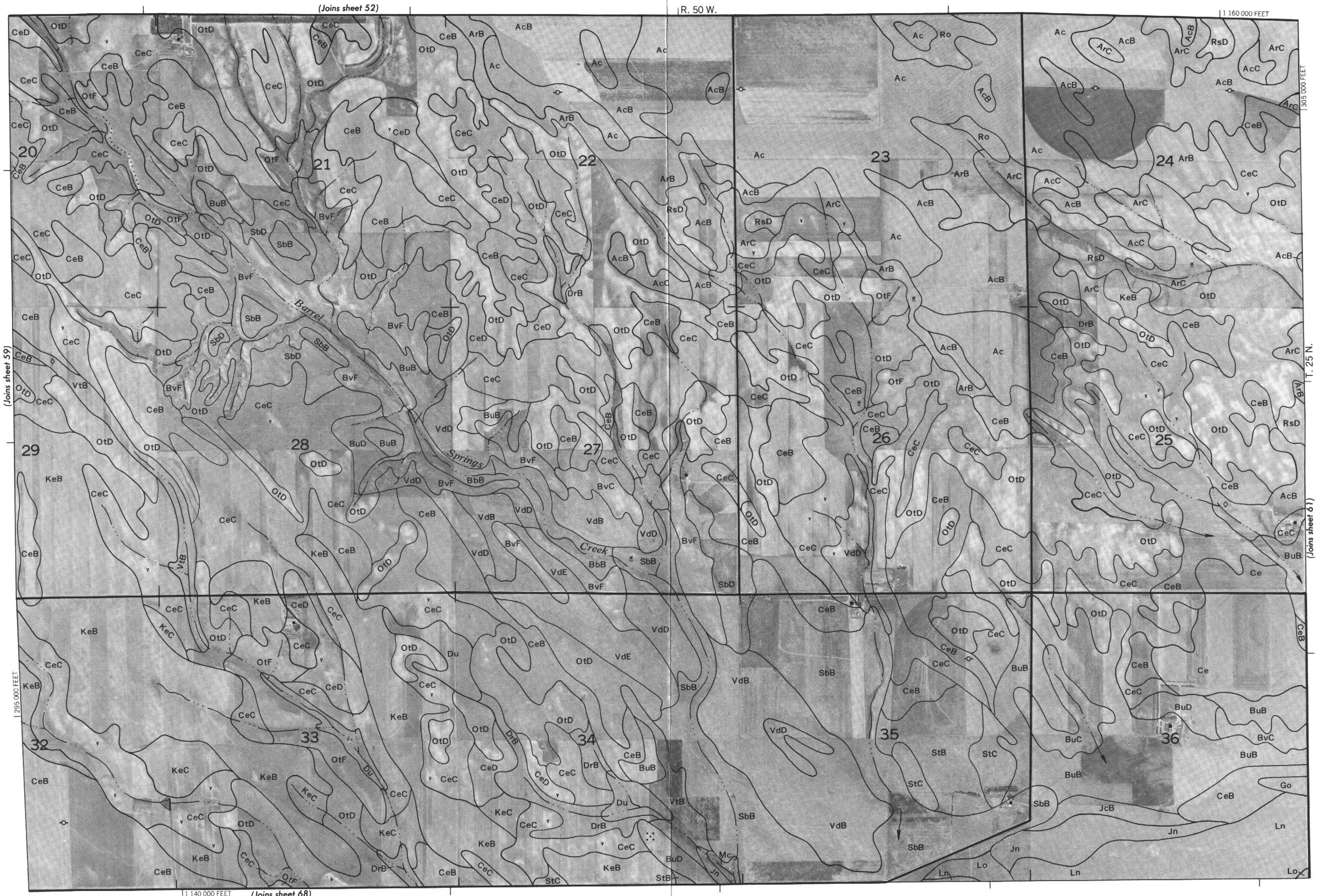
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 58


1 115 000 FEET
R. 51 W. | R. 50 W.
(Joins sheet 51)
305 000 FEET
T. 25 N.
(Joins sheet 58)
(Joins sheet 60)
(Joins 66)
(Joins sheet 67)
1 135 000 FEET
295 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 60

N



1 Mile

5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 60

BOX BUTTE COUNTY, NEBRASKA NO. 61

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

62

N

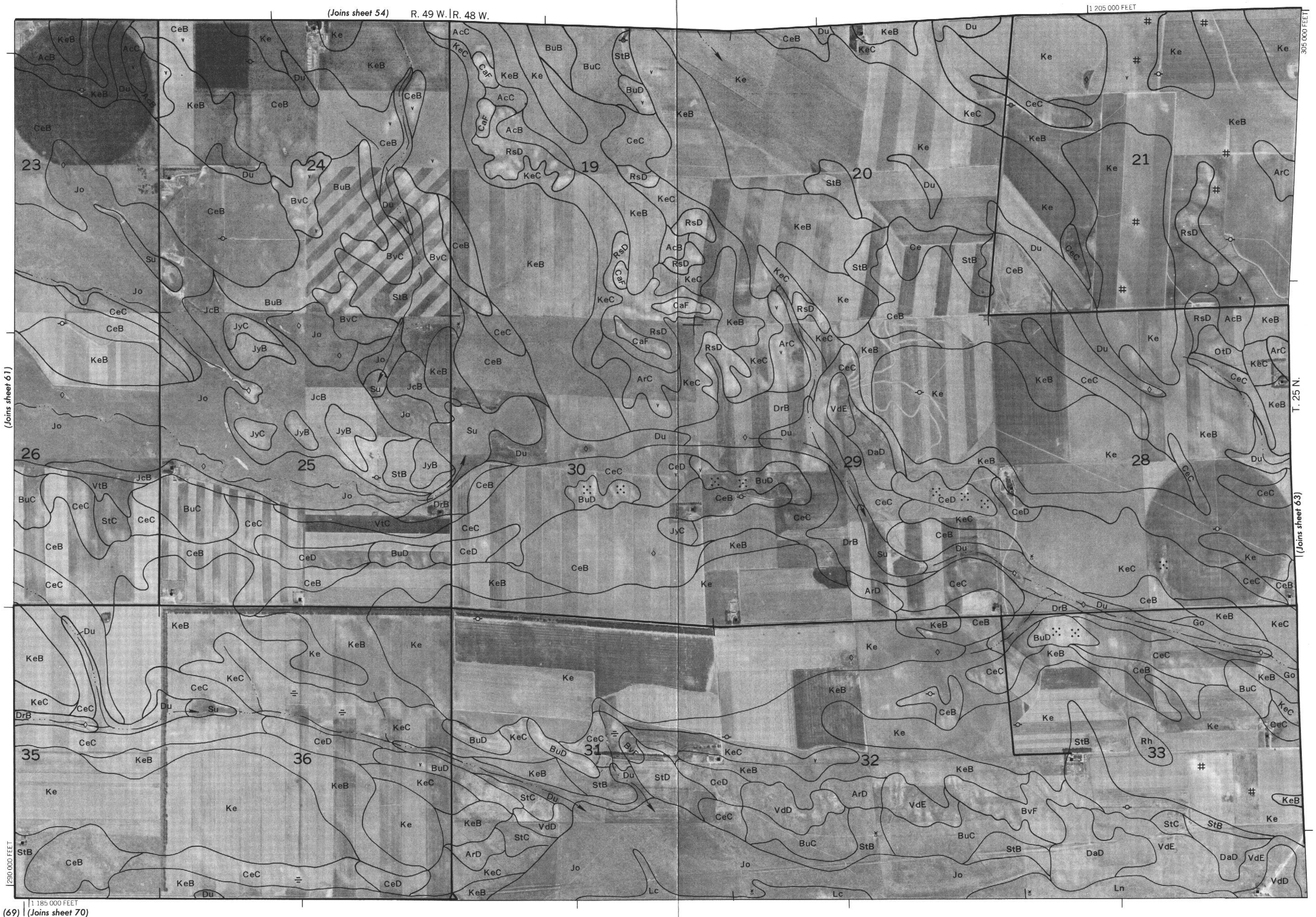
1 Mile

5000 Feet

Scale 1:20000

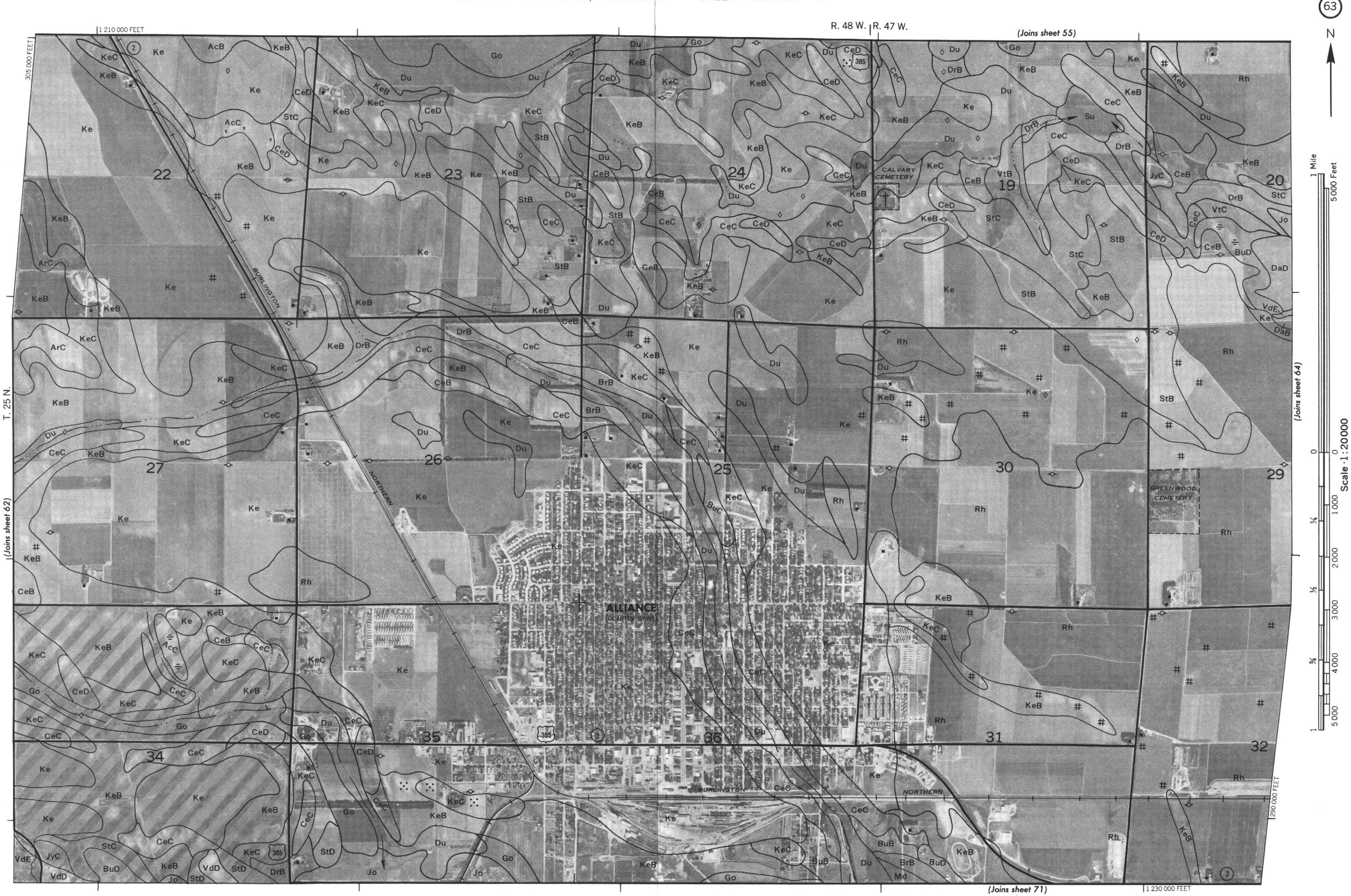
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 62



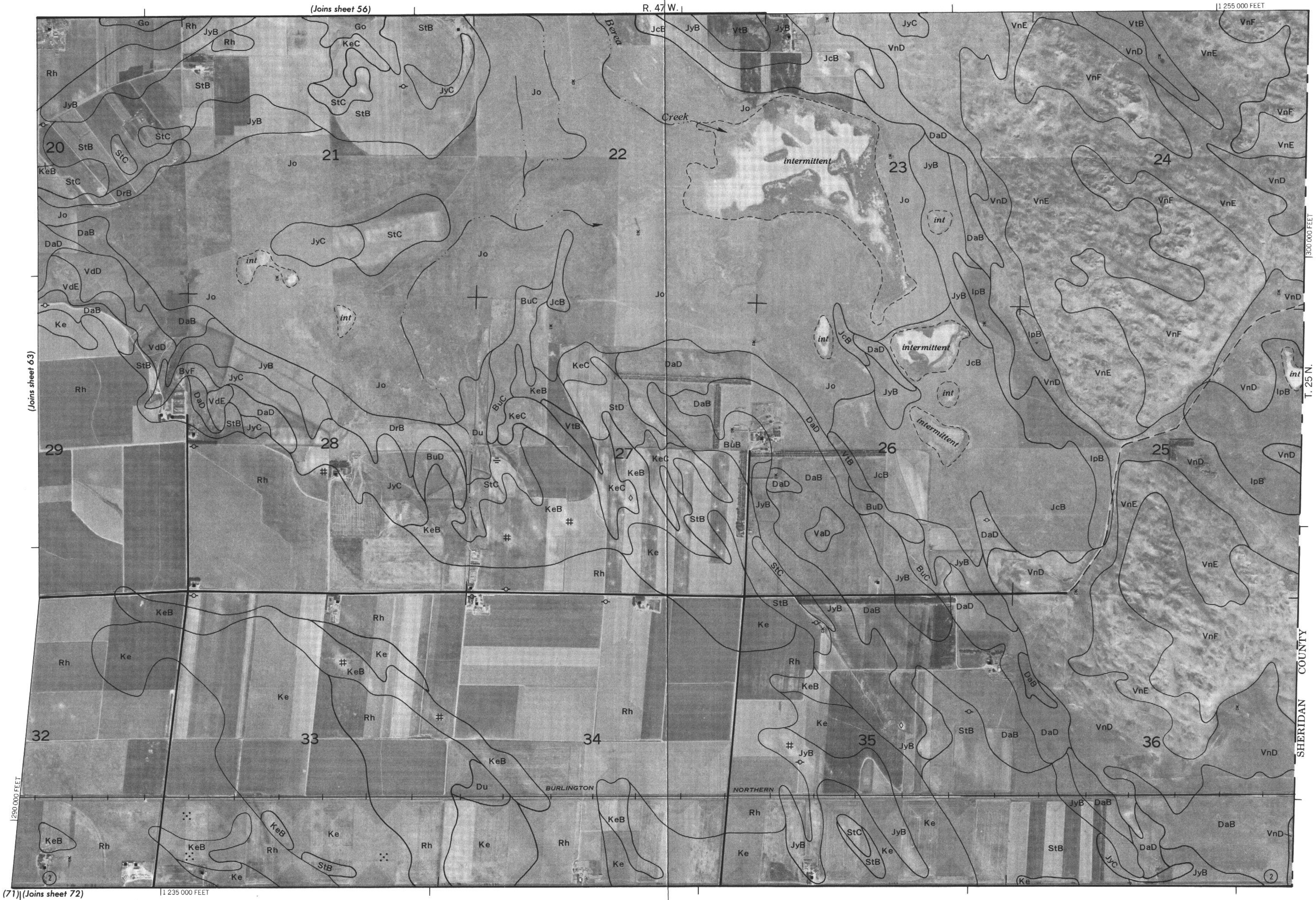
BOX BUTTE COUNTY, NEBRASKA NO. 63

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 64

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

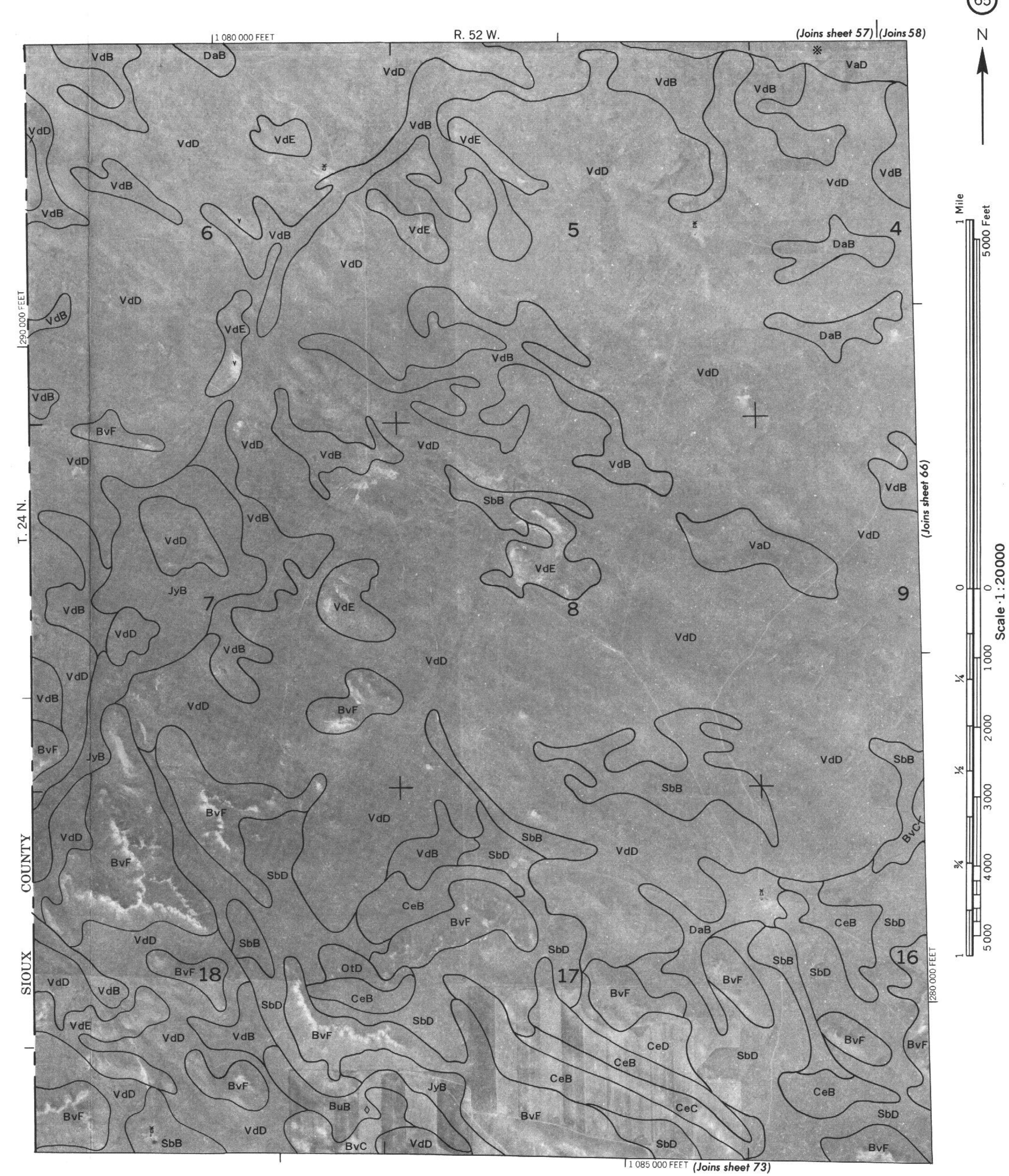


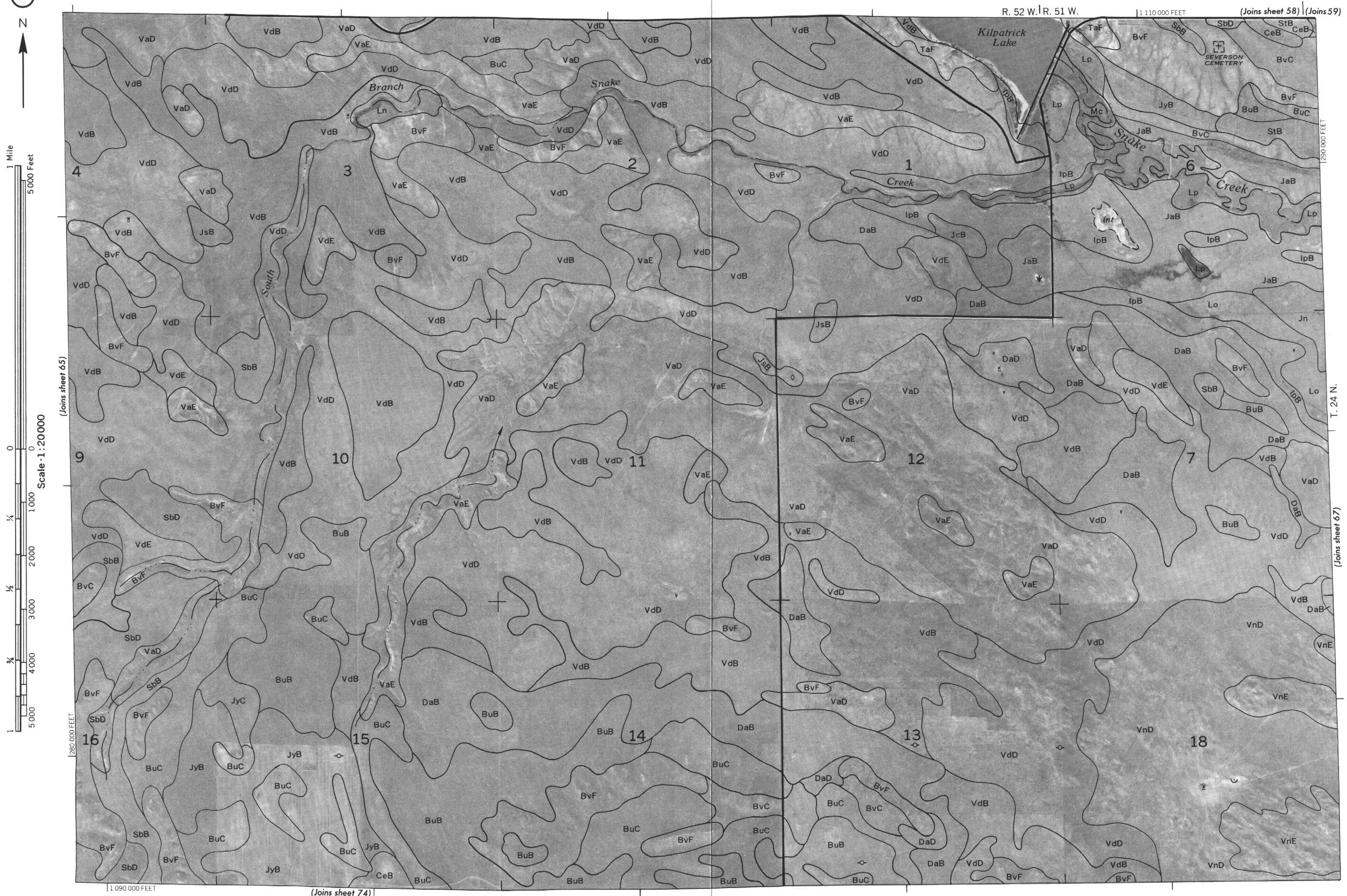
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 64

BOX BUTTE COUNTY, NEBRASKA NO. 65

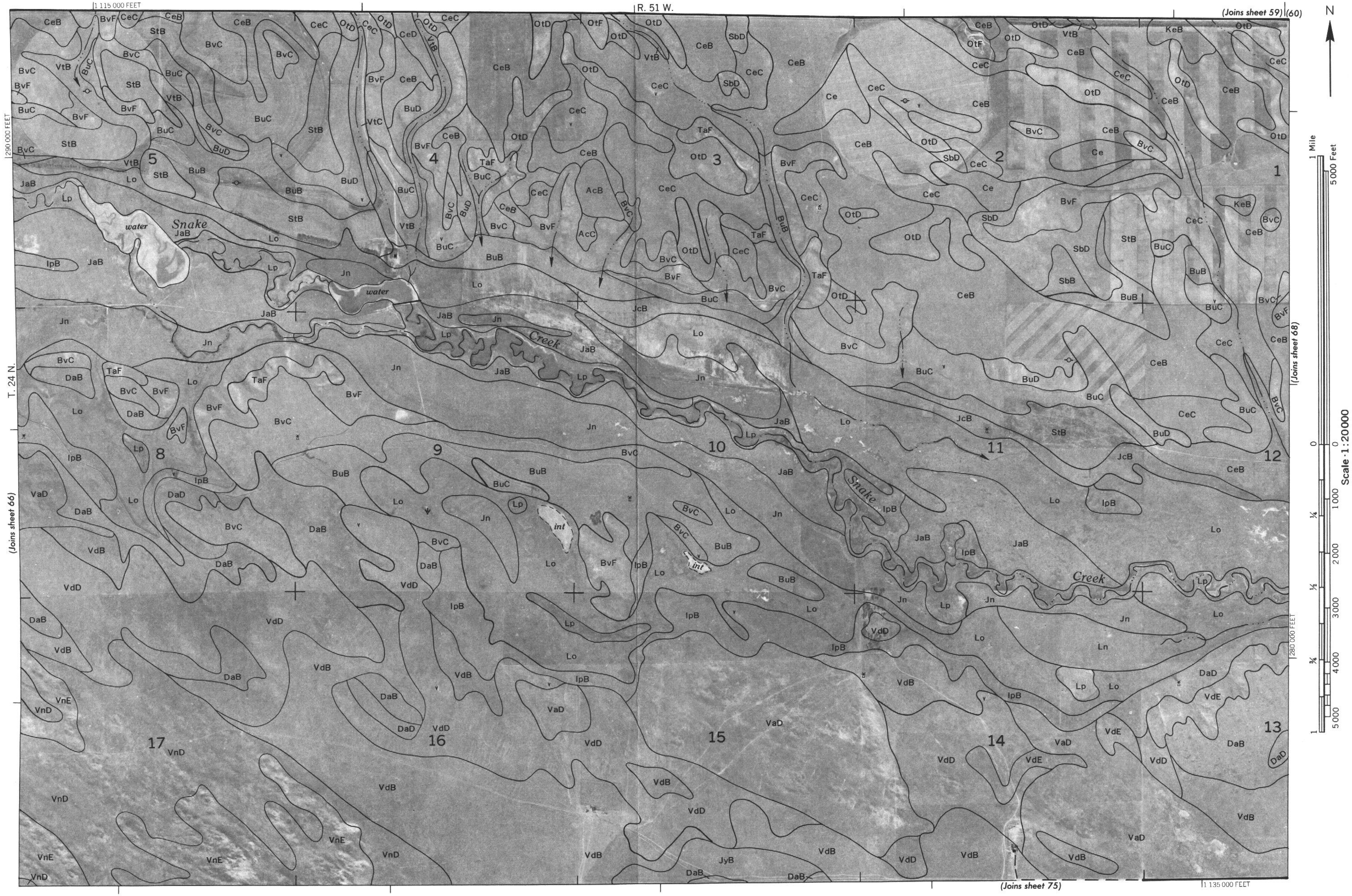
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



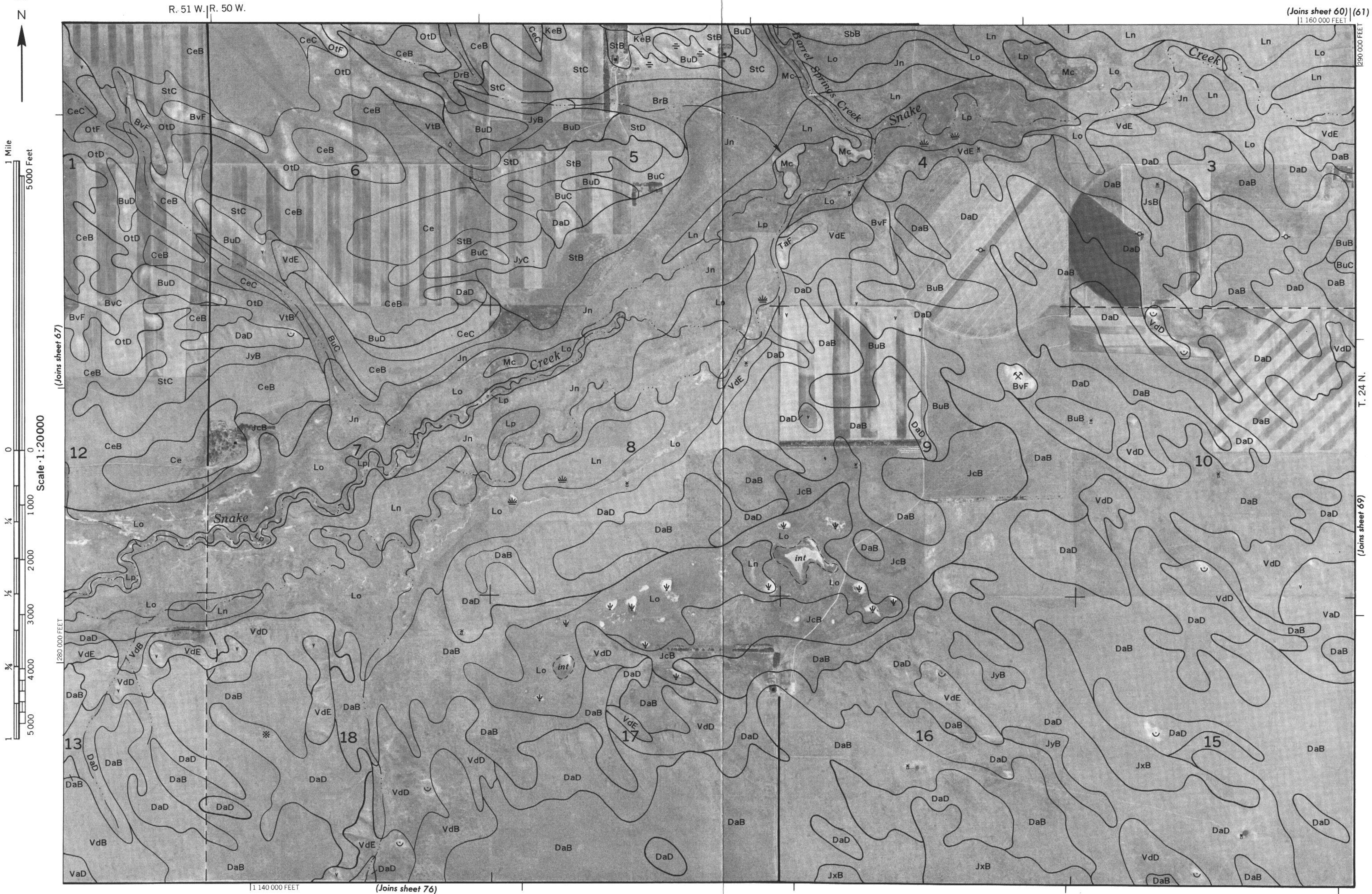


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

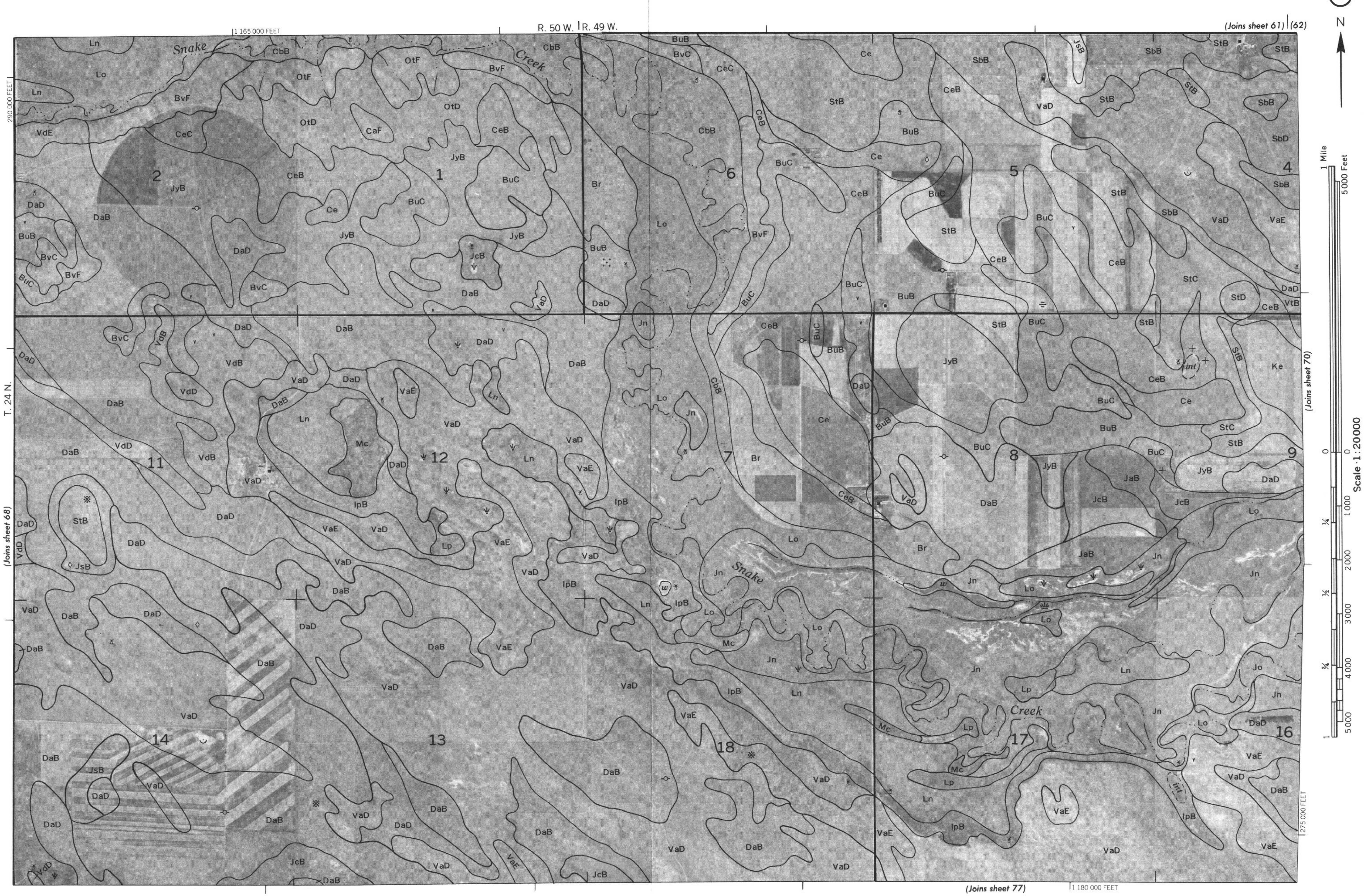
BOX BUTTE COUNTY, NEBRASKA NO. 66



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

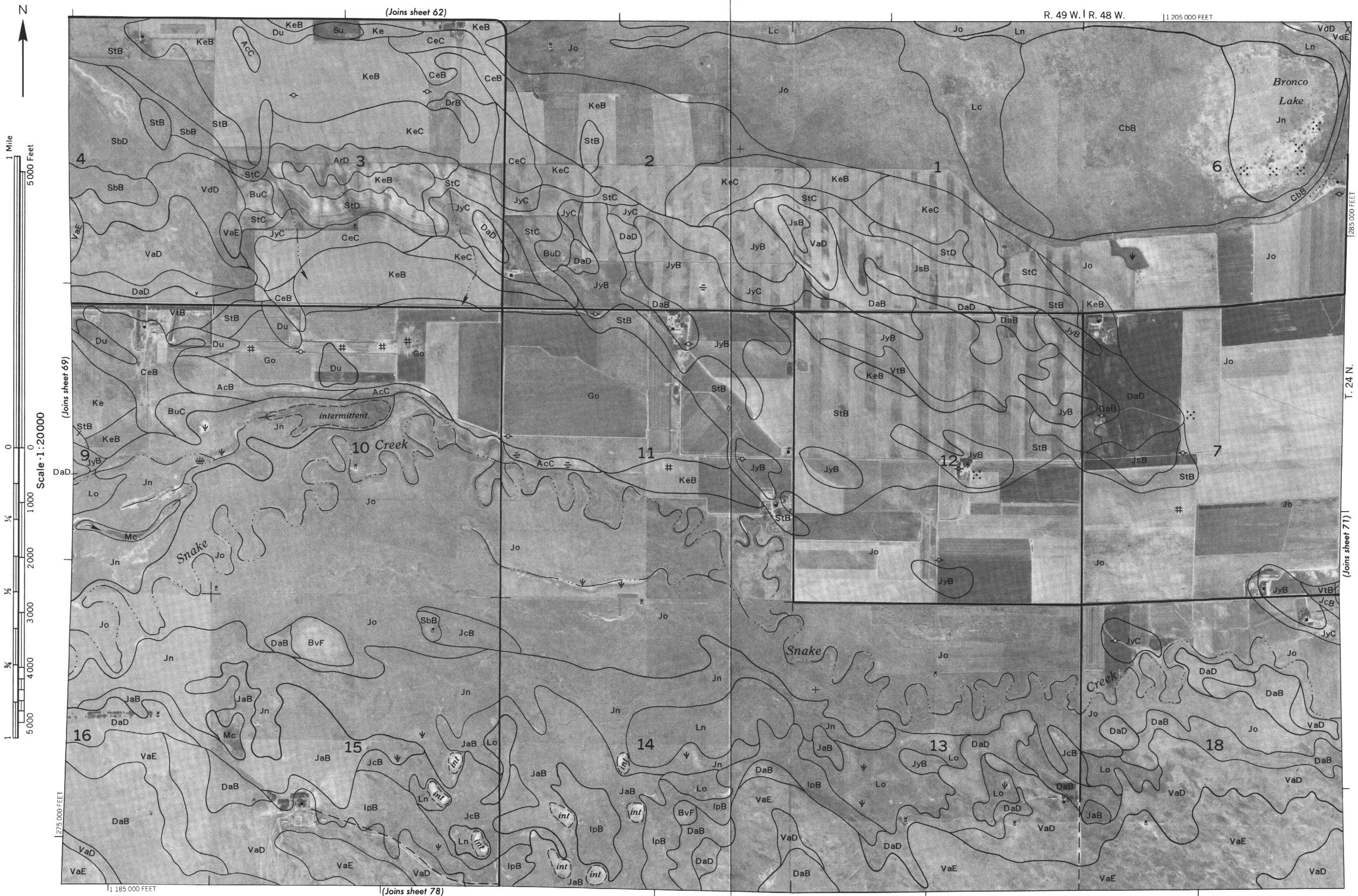


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



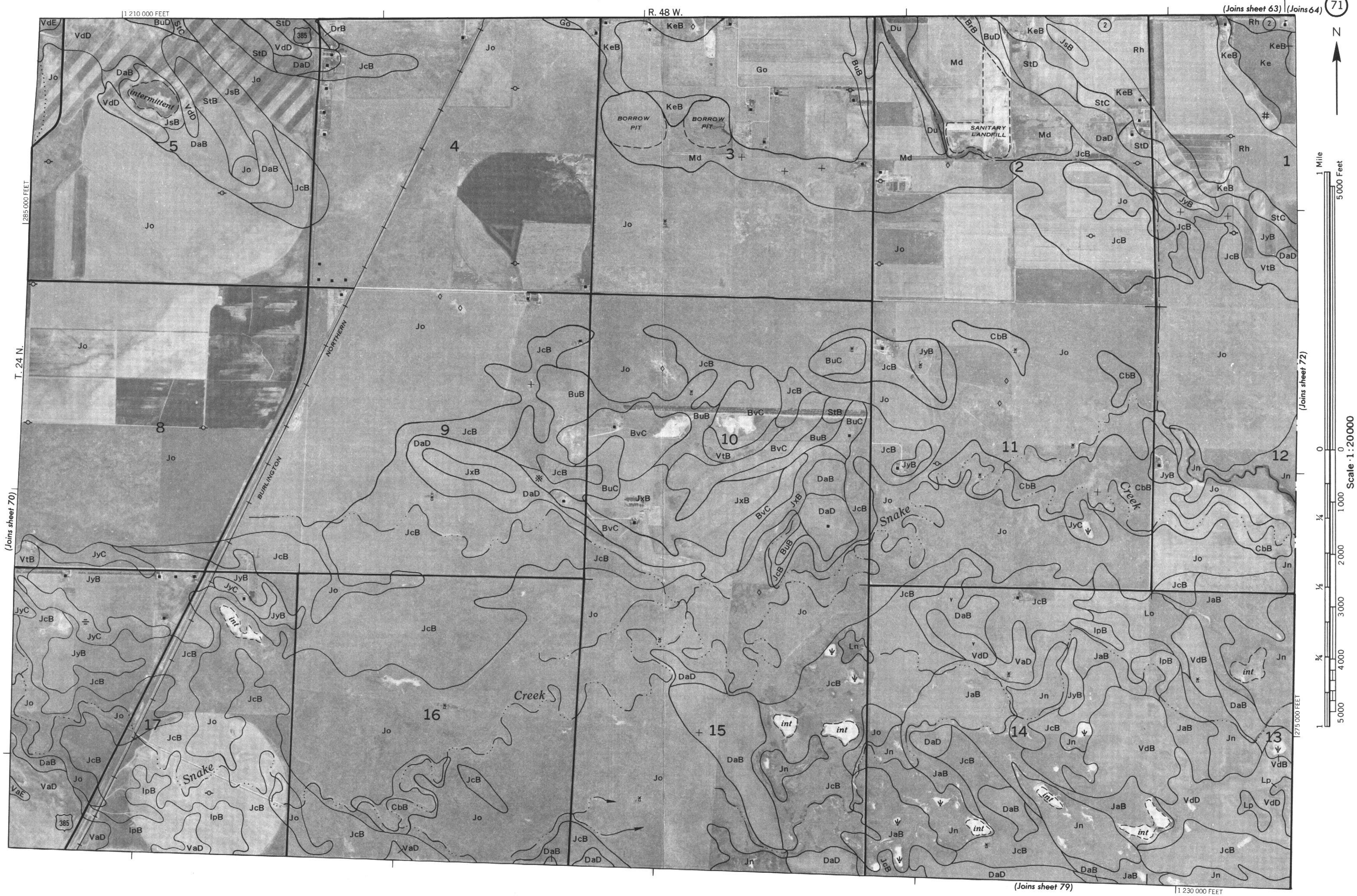
BOX BUTTE COUNTY, NEBRASKA NO. 69

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 70



BOX BUTTE COUNTY, NEBRASKA NO. 71

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 72

SHERIDAN CO.

N

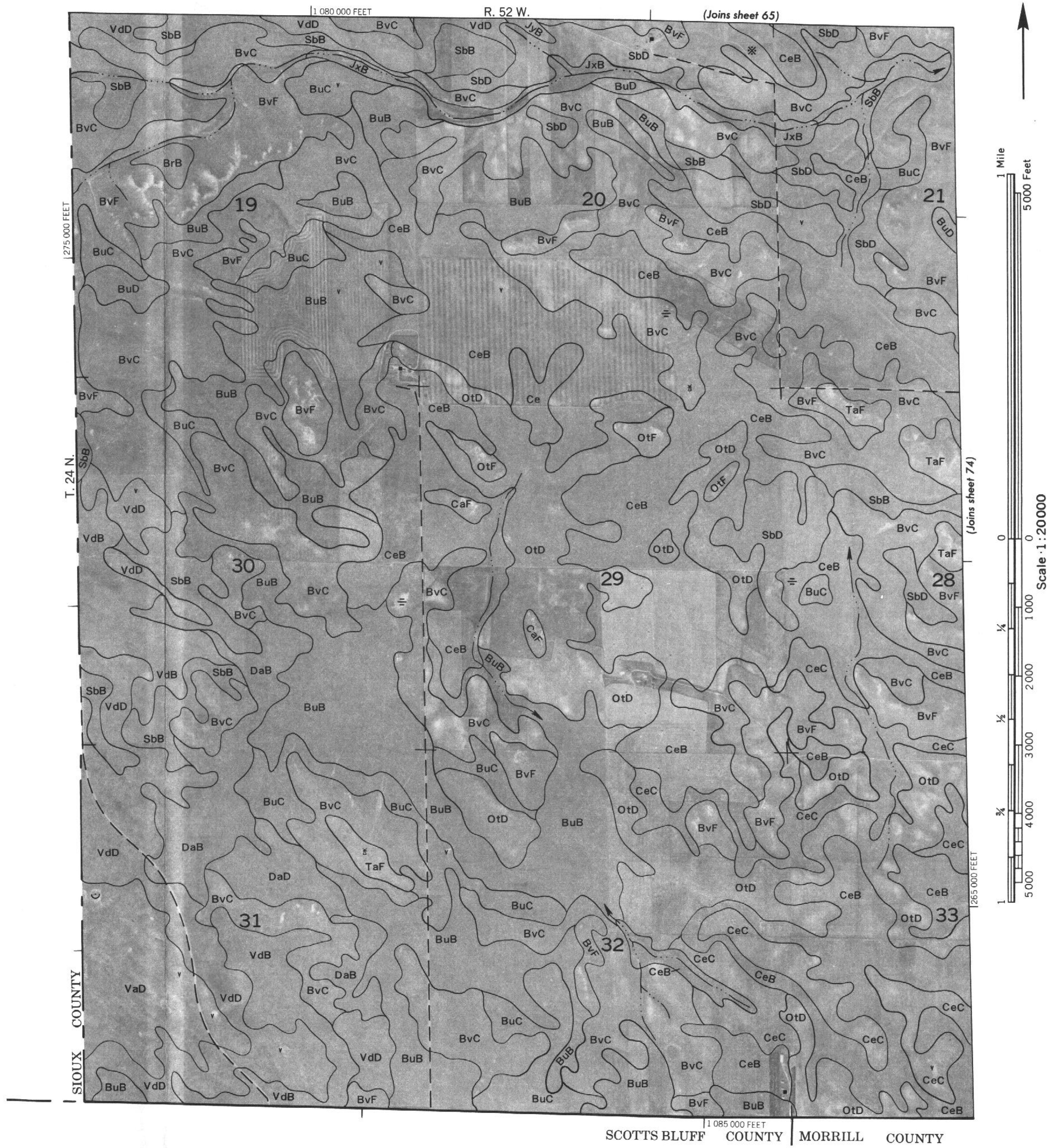
1 Mile
5000 Feet

Scale 1:20000

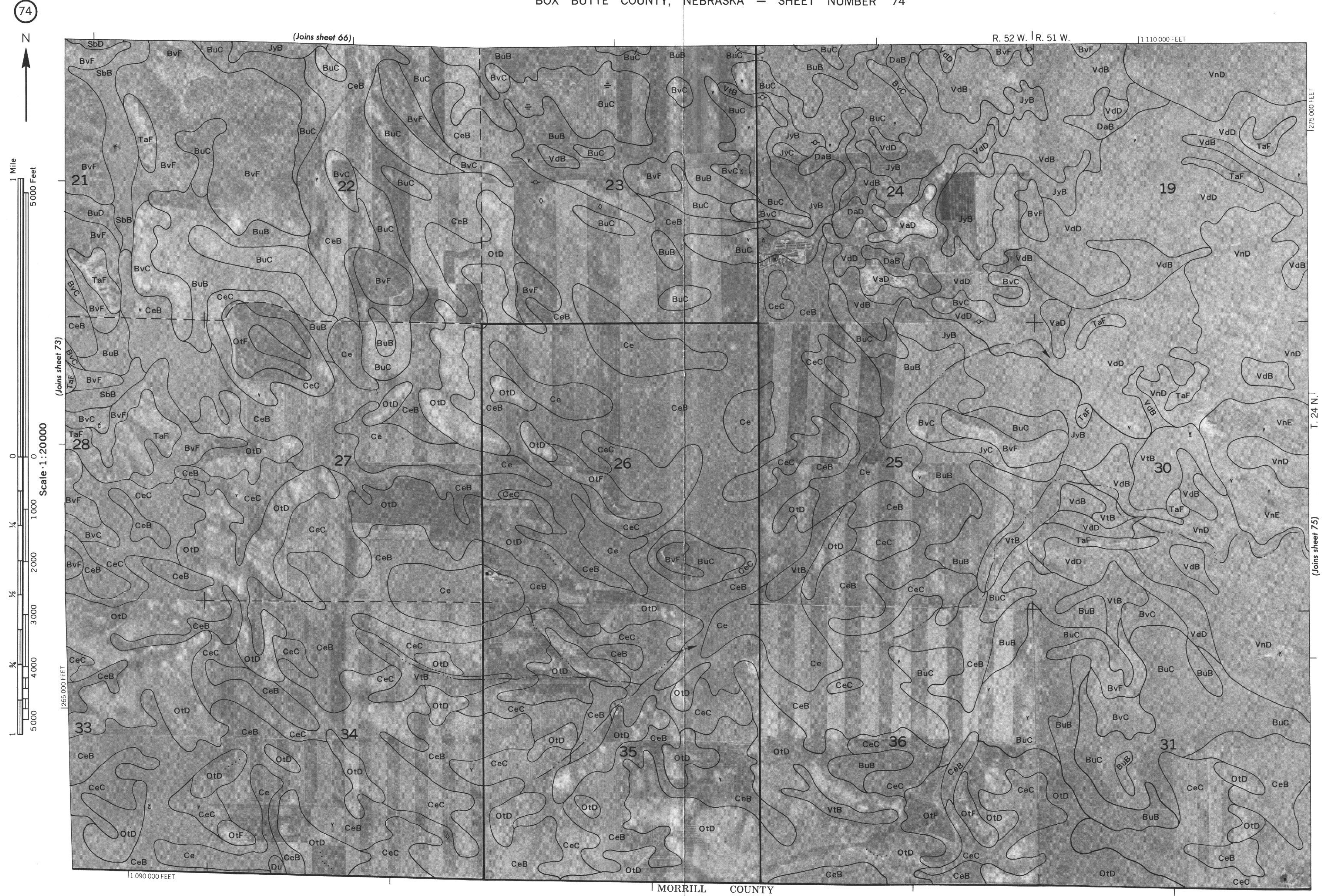
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

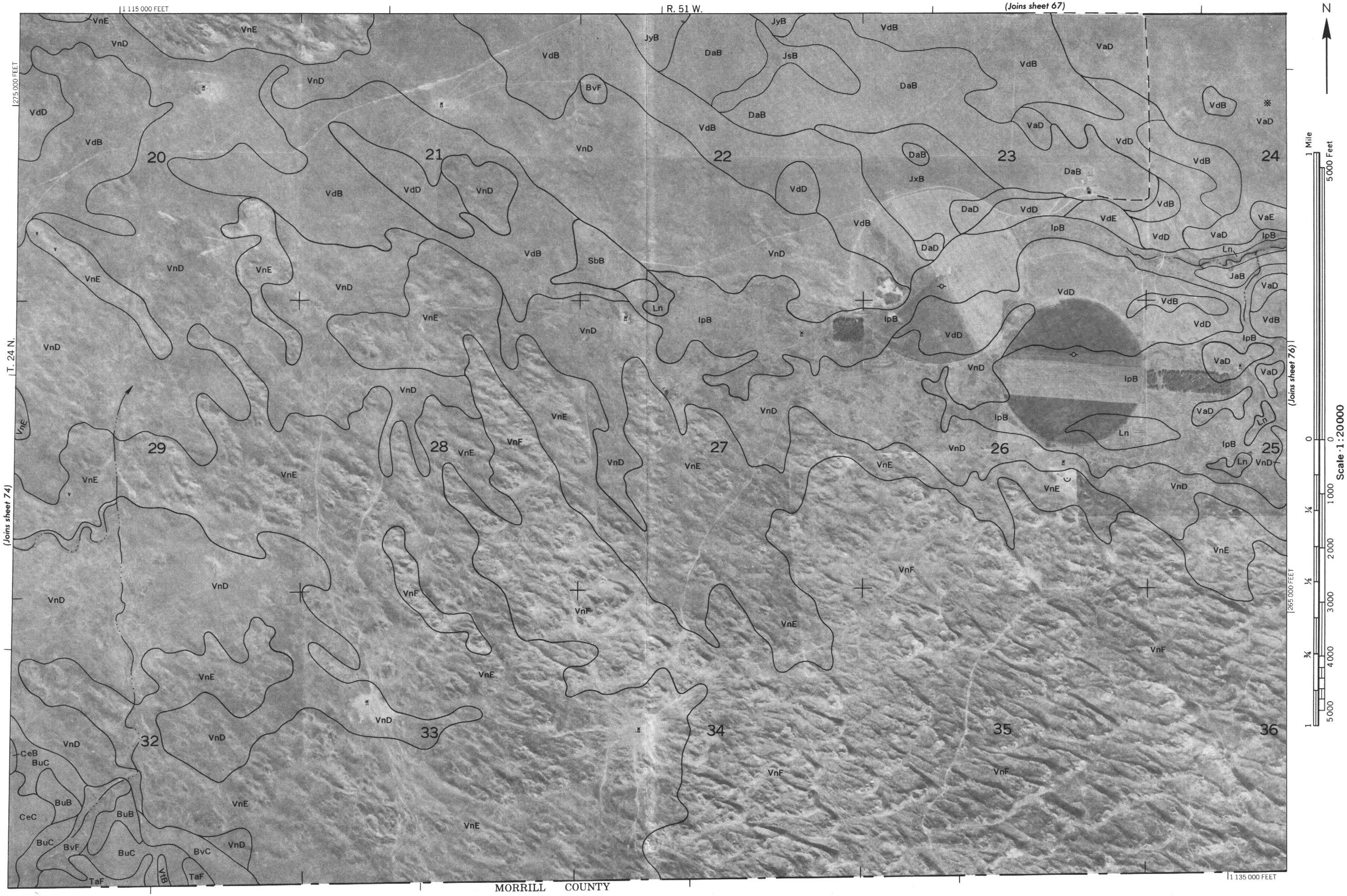
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



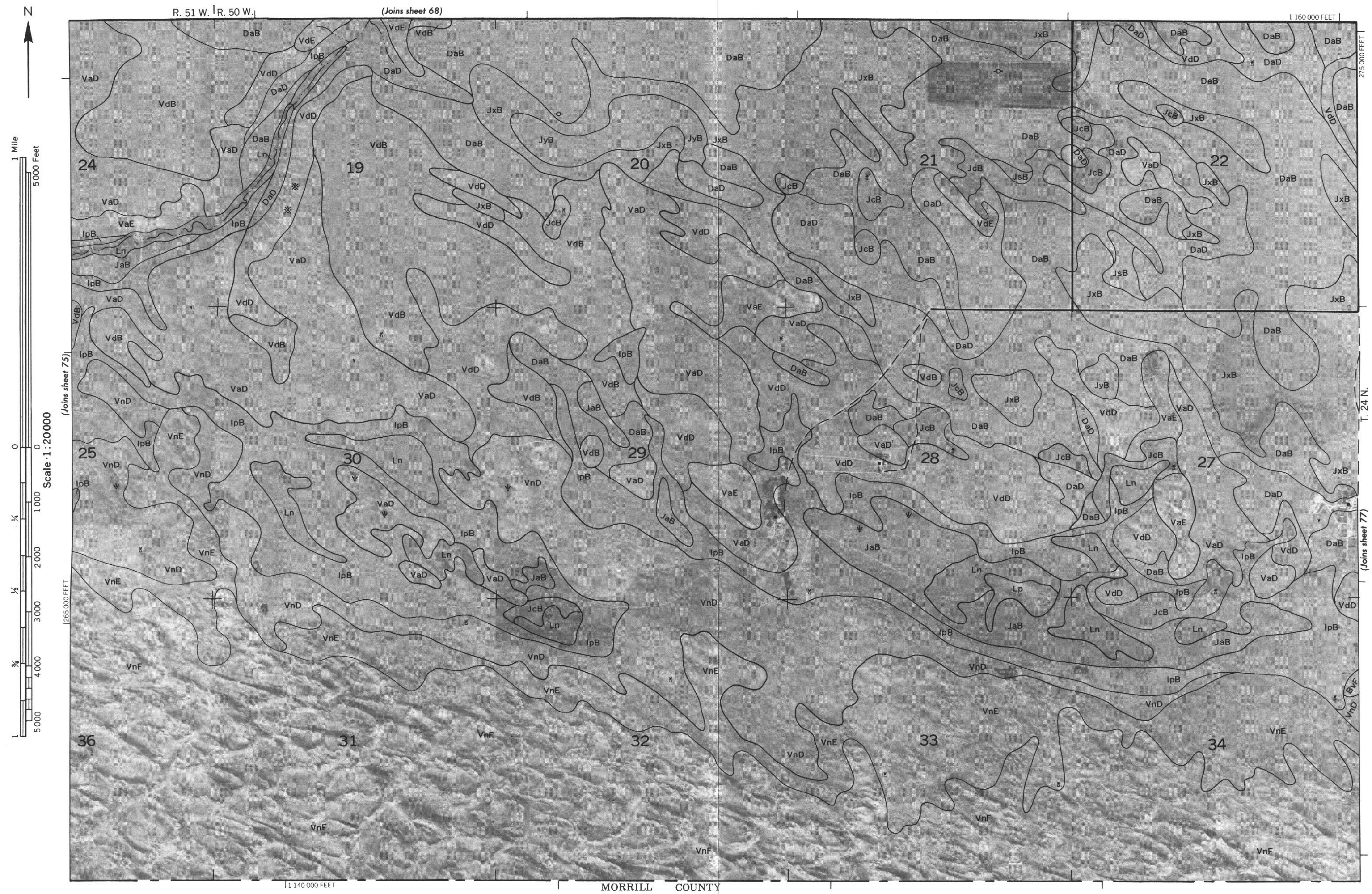
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

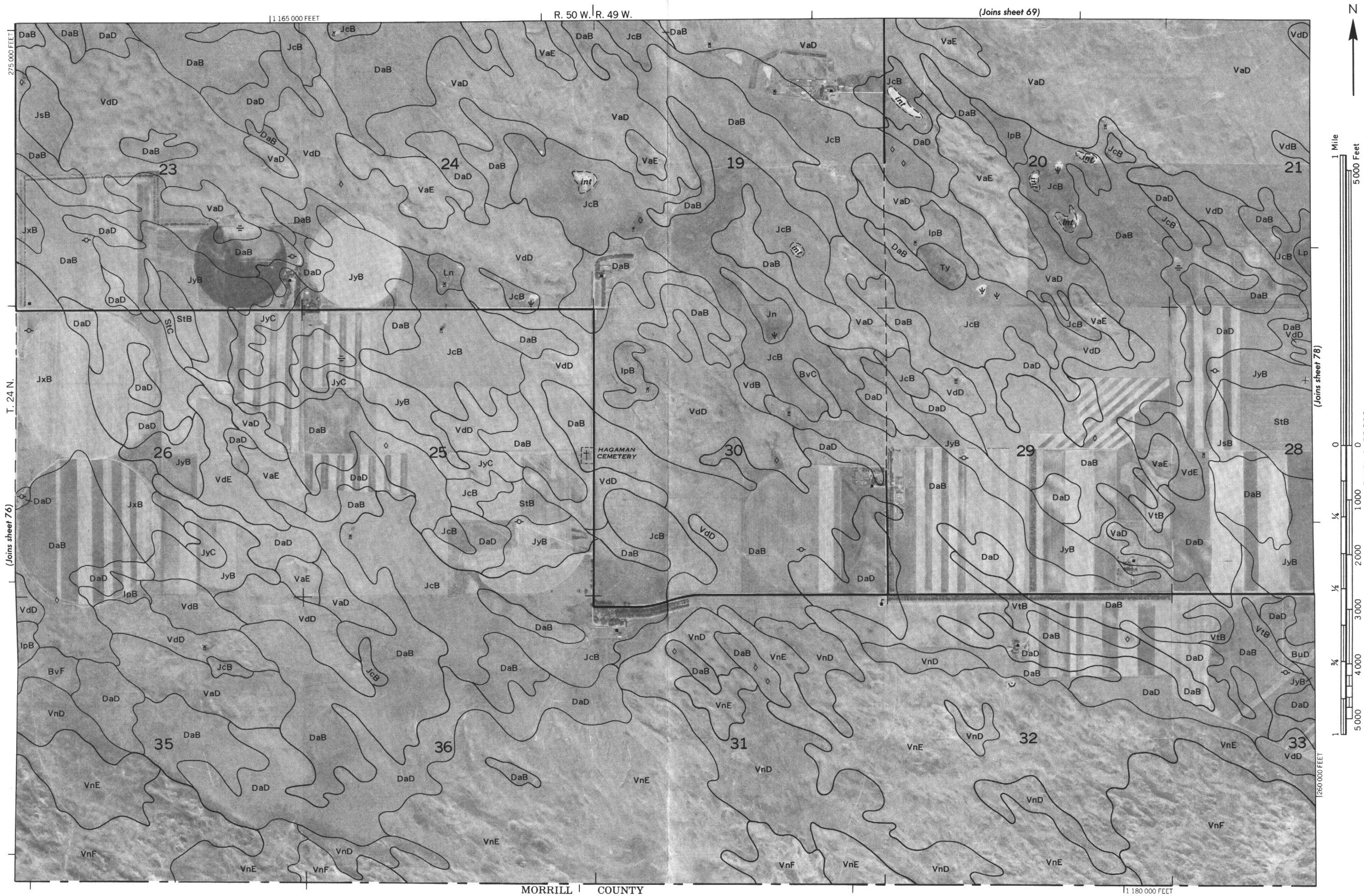


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

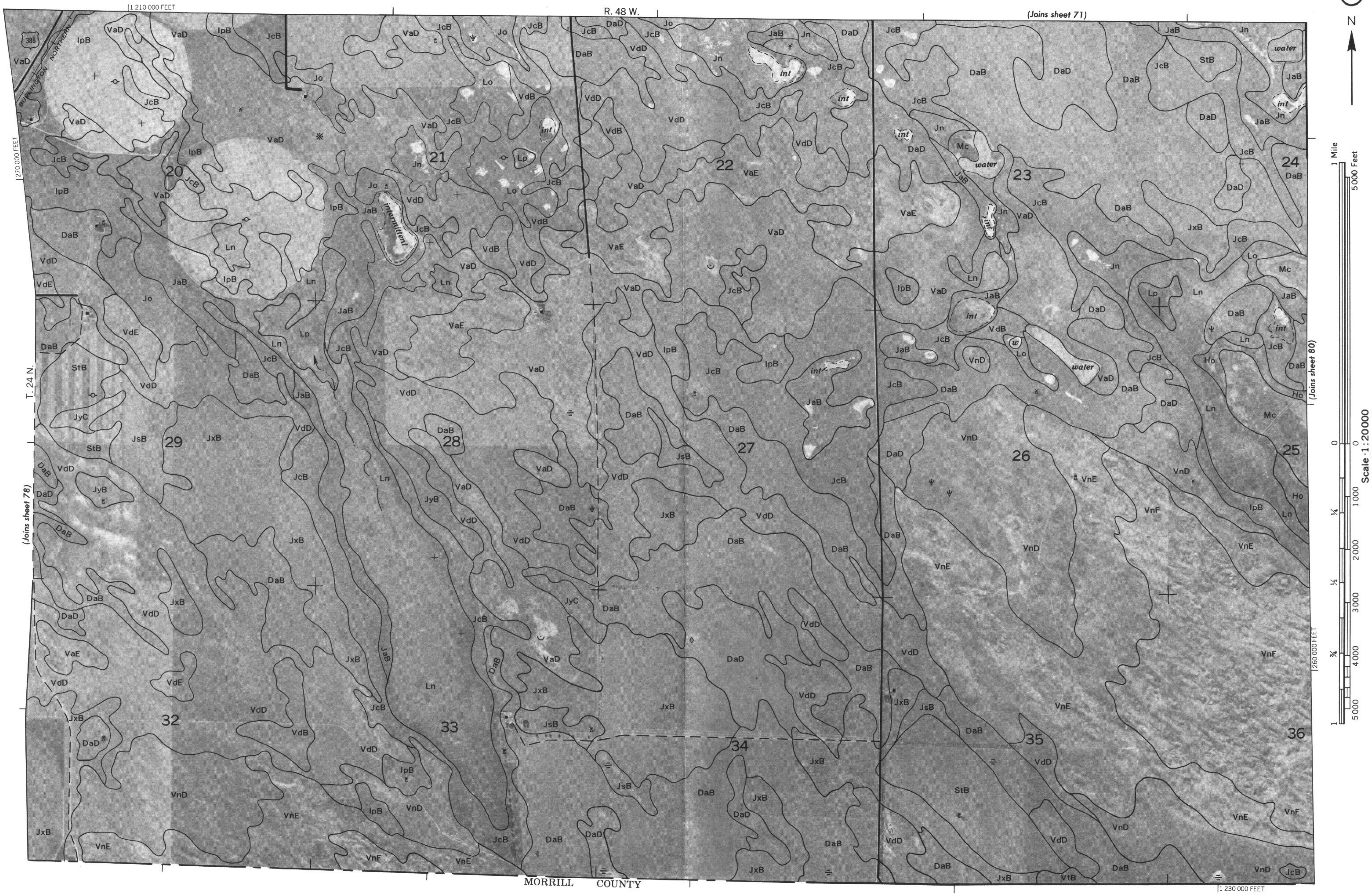


This map is compiled on aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA — SHEET NUMBER 77



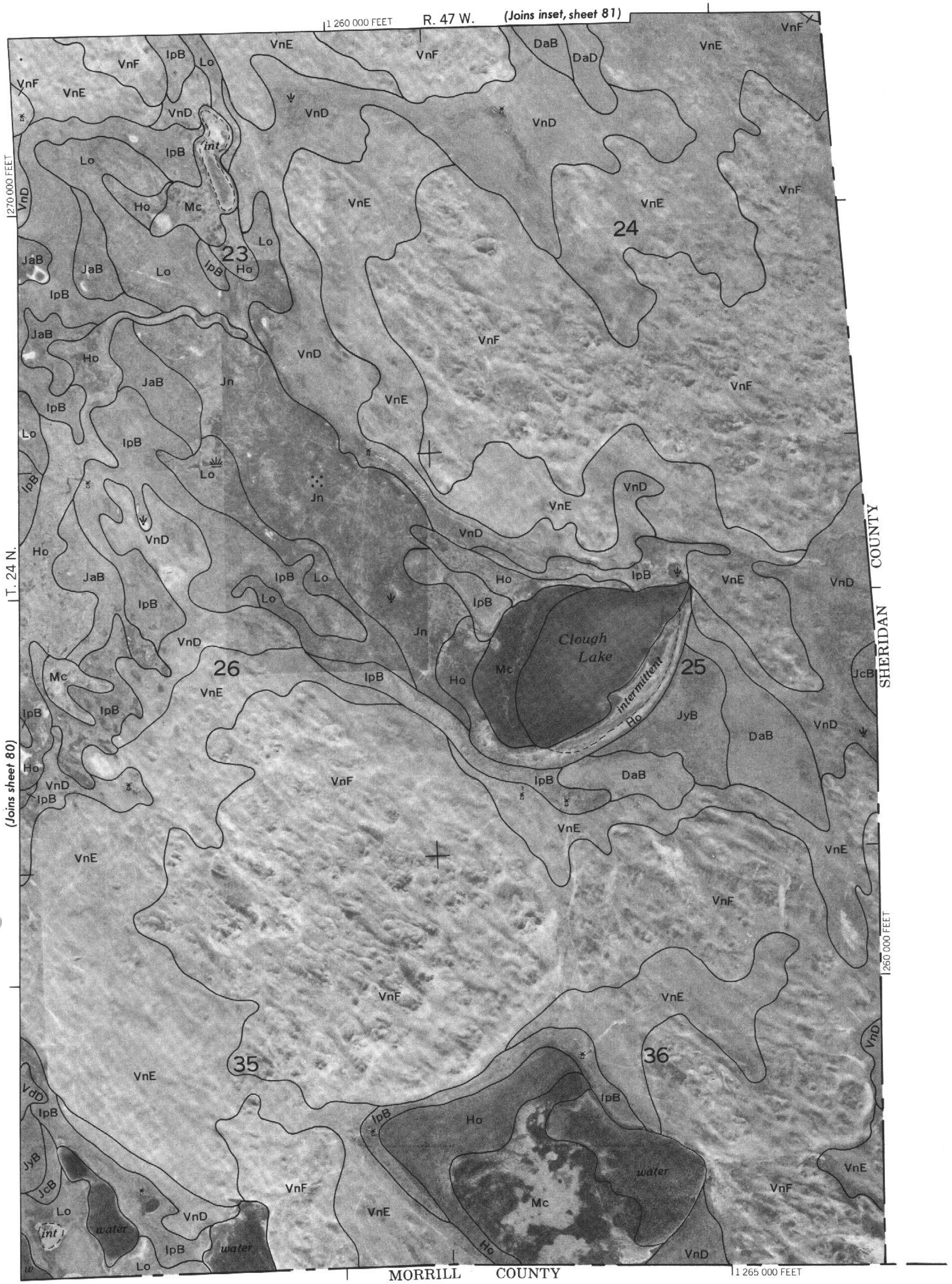
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

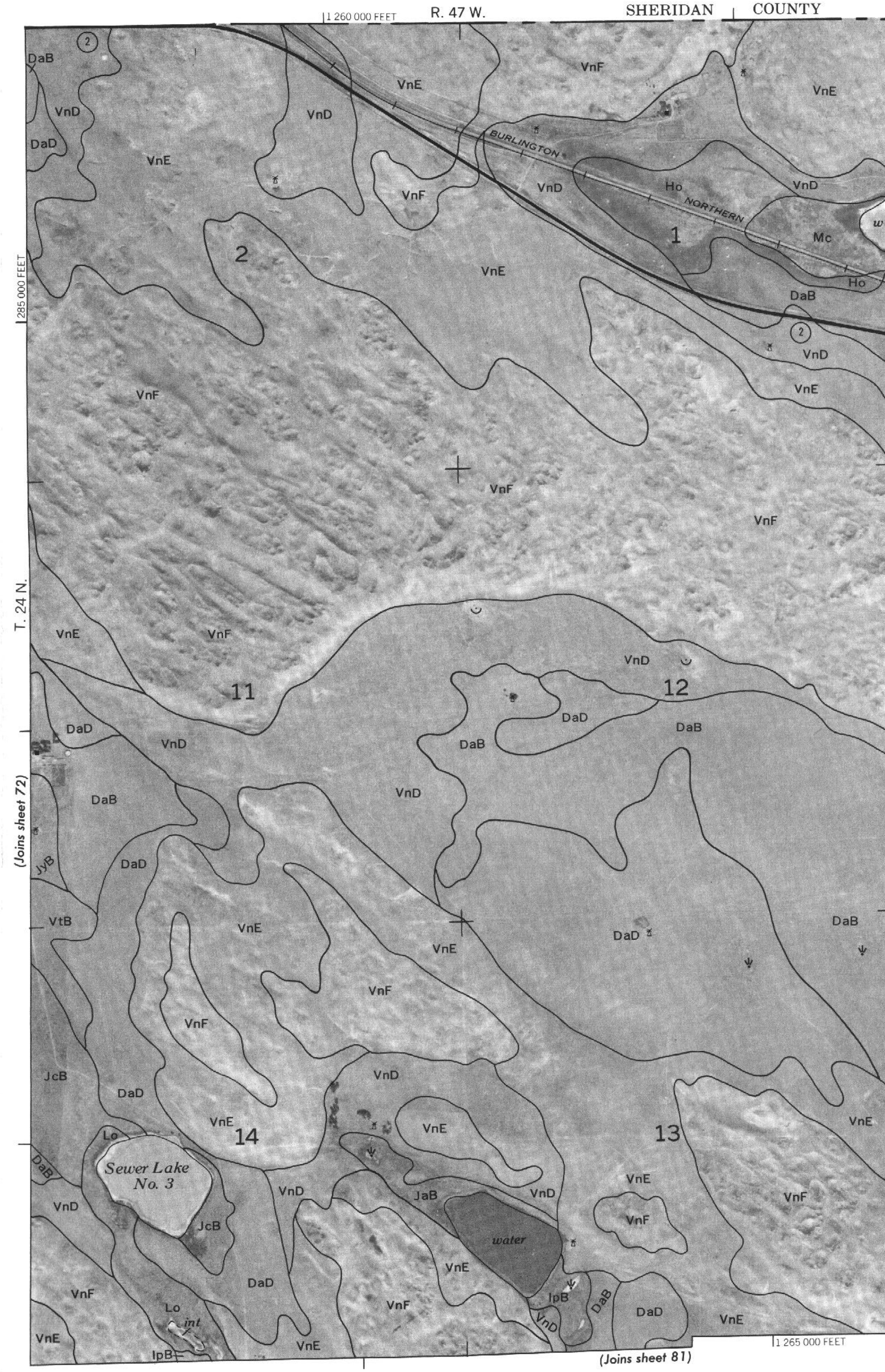


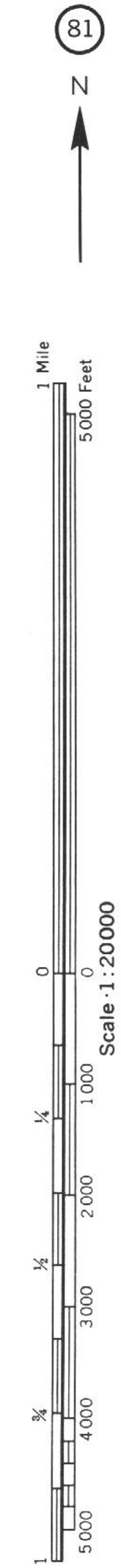
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

BOX BUTTE COUNTY, NEBRASKA NO. 79

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


1 260 000 FEET
R. 47 W.
(Joins inset, sheet 81)
270 000 FEET
T. 24 N.
(Joins sheet 80)
Clough Lake
intermittent
23
24
25
26
35
36
SHERIDAN COUNTY
260 000 FEET
MORRILL COUNTY
1 265 000 FEET
water


1 260 000 FEET
R. 47 W.
SHERIDAN COUNTY
BURLINGTON NORTHERN
285 000 FEET
T. 24 N.
(Joins sheet 72)
1
2
11
12
13
14
Sewer Lake No. 3
water
275 000 FEET
SHERIDAN COUNTY
1 265 000 FEET
(Joins sheet 81)


81
N
1 Mile
5000 Feet
Scale 1:20000